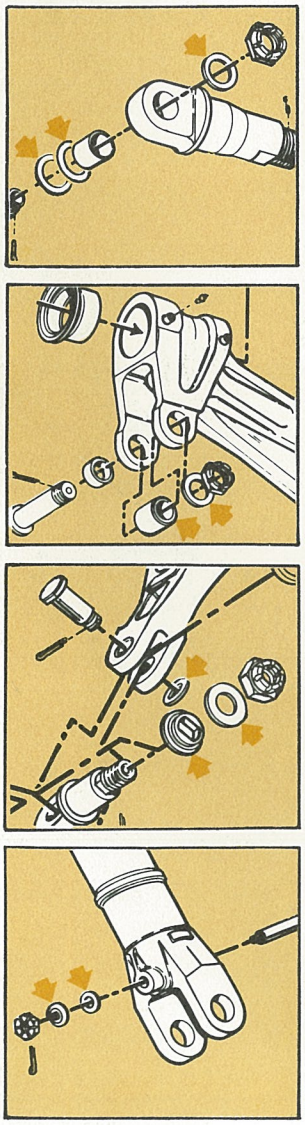
VOLUME XIX NUMBER 1 MAY/JUNE 1967

Convair Traveler



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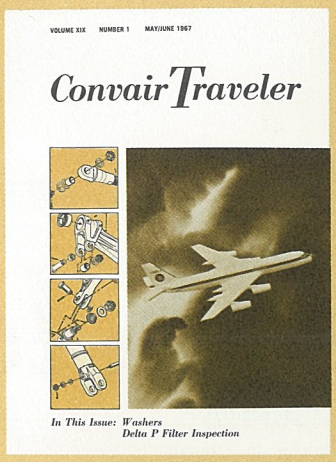


OUR COVER

Would you believe an item as small as a washer could ground an airplane? Would you believe that they provide a sure lock against loosening? help distribute stresses developed by a bolt? provide a positive seal? take up loss of tension or developed looseness between component parts? provide full bearing surface under the bolt? Well, Artist Tony Adams proves it on our cover.

Convair Traveler

VOLUME XIX NUMBER 1 MAY/JUNE 1967

IN THIS ISSUE

A digest of operation and service published monthly by the Technical Publications Section of GD Convair, primarily for the interest of Convair operators.

CONVAIR DIVISION OF GENERAL DYNAMICS

Washers

WASHERS ARE USED as spacers; as locking devices for bolts, screws, and nuts; and to provide additional bearing area for high-tension load. They are a preventive against galvanic corrosion when dissimilar metals are used together. Washers are not to be used except when necessary to perform one of these foregoing specific functions.

Standard types of aircraft washers are listed in Table I.

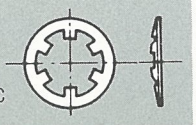
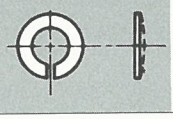
Standard spacer washers are used where it is desirable to protect the surface from damage while tightening bolts, screws, or nuts; and to provide adjustment for castle nuts and drilled shank bolts.

Lockwashers are not to be used as the sole locking device for bolts, screws, or nuts on structural parts or assemblies. Special washers are to be used for high-tension bolts to compensate for the fillet radii between shanks and heads (see fig. 1).

TABLE I

PART NO.	TYPE	MATERIAL	REMARKS
AN935	 SPRING LOCK	Steel Phosphor bronze	1. Use only as a last resort to lock plain nuts 2. Do not use on primary or secondary structures. 3. When used against magnesium, aluminum or other soft metals, a plain washer shall be used beneath the lockwasher.
AN936	 TOOTH LOCK	Steel Bronze	1. Use only where required for electrical bonding in conformance with MIL-E-4158.
AN950	 BALL SOCKET	Steel	1. Use with ball seat washer AN955. 2. Use for applications where bolts are installed at an angle to the surface or where perfect alignment with the surface is required at all times.
AN955	 BALL SEAT	Steel	1. Use with ball socket washer AN950. 2. Use for applications where bolts are installed at an angle to the surface or where perfect alignment with the surface is required at all times.
AN960	 PLAIN	Carbon steel CRES steel Aluminum al. Alloy brass. Copper	1. Use for most general aircraft applications with bolts in tension to provide more bearing area. 2. Also use for spacer washers under castellated nuts, etc.
AN961	 PLAIN ELECTRICAL	Brass spec. QQ-B-61	1. Use for electrical applications only.
AN970	 FLAT-WOOD	Steel	1. Use for bolts or screws in tension through wood and other soft materials. 2. Has large O.D. for more bearing area.
AN975	 TAPER PIN	Steel spec AN-QQ-S-646 or AN-S-11	1. Use with threaded taper pins. 2. Install for adjustment where plain washers would distort.

TABLE I (continued)

PART NO.	TYPE	MATERIAL	REMARKS
NAS 143	 125,000 145,000 PSI C'SUNK AND PLAIN	Steel 4130 spec. AN-QQ-S-685 or equivalent	1. Use countersunk type under high-tension bolt heads with fillet radii. 2. Use plain type under nuts.
NAS 460	 TAB WASHER	Soft steel Cad. plate	1. For use on keyed shafts; tabs are bent over nut flats.
NAS 549	 PHENOLIC FIBRE	Type PBE-P PHENOLIC	1. Used as an insulating washer.
NAS 620	 REDUCED O.D.	Carbon steel Cad plate Aluminum Alloy	1. Primarily for mounting components in areas of bend radii and other interference.
NAS 1061	 LOCK, HI-TEMP	CRES, 301, 302 or 303 SC	1. For high temperature applications to 800°F.
99-52505 -001	 LOCK,CAMLOC FASTENER	Carbon steel Cad. plate	1. For retaining Camloc 2600 and 2700 series studs in rigid position.
99-53600 -001 & -005	 SPLIT, CAMLOC FASTENER	Spring steel Cad plate 18.8 CRES	1. For retaining 4002 series Camloc studs. Use on -16 and longer studs.
99-55600 -002 & -004	 SPLIT, CAMLOC FASTENER	Spring steel Cad. plate 18-8 CRES	1. For retaining 2600 and 2700 series Camloc studs in the non-rigid position. 2. Use on studs -5 and longer.

Star or tooth type washers serve to lock the fastener to component part of an assembly. They are not to be used on soft surfaces or where scratching and marking of a part is possible. A smooth washer is recommended in such areas. The external type lockwasher, having teeth on the largest radius, provides greater torsional resistance than does the internal lockwasher. It is used with a fastener having a head large enough (round, pan, or binding head) to contact the lockwasher teeth.

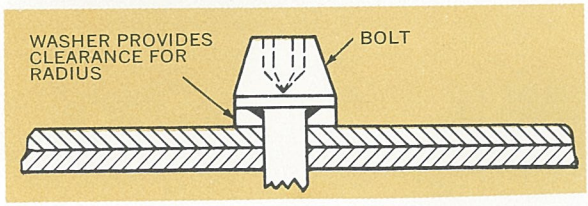


Figure 1. Installation of washer with high-tension bolt.

Internal type washers are used under small-head screws, such as fillister head. It is often used where it is desirable to hide the teeth for appearance sake.

Spring washers are used to take up developed looseness or loss of tension between component parts of an assembly, and to facilitate assembly and disassembly of bolted fasteners by decreasing friction and resistance between the bolted surface and the bolt or nut bearing face.

Filler washers may be used to permit installation of a longer bolt, if correct length bolt is not available. A maximum of two filler washers may be used but only when necessary. They are to be added between the nut and insulating washer, if insulating washer is specified. No washers are permitted under the bolt head unless specified on the drawing. A maximum of two filler washers may be used between the nut and insulating washer, but only if actually needed.

Pre-Load Indicating (PLI) washers are used on assemblies where the nut is inaccessible for applying a torque wrench, or where a specific torque is required. The PLI washer assembly consists of four washers—an inner and outer washer between two special close-tolerance flat washers (fig. 2). The inner washer is slightly thicker than the outer washer and will compress when sufficient torque is applied to the nut. When the inner washer is compressed to the approximate thickness of the outer washer, the nut is properly tightened. The outer washer has holes on the peripheral edge to permit testing with a small lever while tightening the nut. The predetermined load of the bolt is indicated when the inner ring is compressed to a point where the outer ring can no longer be turned freely by a small lever or pin inserted in one of the peripheral holes.

See Table II for bolt/washer identification data.

Installation of PLI washer assembly is made as follows:

1. Place washer assembly on bolt, under nut, as shown in figure 2. Insert a small hardened steel lever, approximately 0.060 diameter by 4 inches long in a hole in the outer washer periphery. A #52 or #53 drill rod or a small allen wrench makes a good lever. *Do not use a paper clip or other wire.*

2. While turning the outer washer with the lever, tighten the nut. When outer washer ceases to rotate, stop tightening the nut. Change lever to another hole in outer washer and apply hand pressure until washer will not move.

3. Check for gaps between faying surfaces of washers, structure, or nut. Gaps are not permitted between washer and nut or between washer and structure. A gap is permissible, however, between one close-tolerance washer and the outer washer, permitting 0.002 maximum feeler gage to contact inner washer, provided a minimum of 50% outer washer circumference is in full bearing. If gaps are in excess of these limits, washers are to be replaced and the tightening procedure repeated.

4. If a nut is backed off or removed after tightening, the entire washer assembly is to be replaced and the tightening procedure repeated.

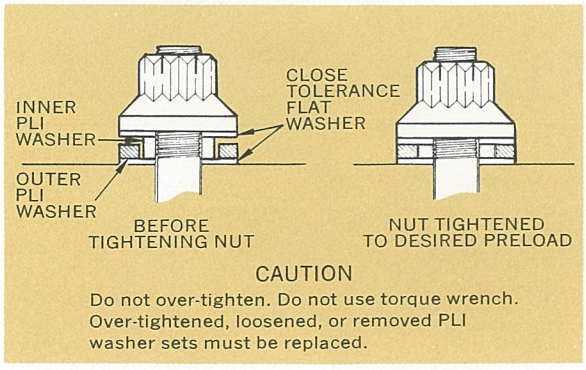


Figure 2. Pre-load Indicating (PLI) washer installation.

TABLE II

P.L.I. WASHERS

For bolts rated at 220,000 psi Min.			—Color—Olive Drab (Inner and Outer Washers)	
*PART CONTROL NUMBER	*VENDOR NUMBER	BOLT SIZE (Nom.)	"A" DIA. ± .010	"W" BEFORE LOADING ± .010
99-53800-001	PLI 22-4-5.0	1/4"	.491"	.231"
99-53800-002	PLI 22-5-8.1	5/16	.616	.243
99-53800-003	PLI 22-6-12.4	3/8	.750	.255
99-53800-004	PLI 22-7-16.7	7/16	.873	.268
99-53800-005	PLI 22-8-22.7	1/2	1.005	.311
99-53800-006	PLI 22-9-28.7	9/16	1.139	.323
99-53800-007	PLI 22-10-36.4	5/8	1.255	.335
99-53800-008	PLI 22-12-53.3	3/4	1.523	.362
99-53800-009	PLI 22-14-72.9	7/8	1.780	.449
99-53800-010	PLI 22-16-97.9	1	2.050	.473
99-53800-011	PLI 22-18-122.9	1 1/8	2.295	.499
99-53800-012	PLI 22-20-154.8	1 1/4	2.565	.527
99-53800-013	PLI 22-22-190.3	1 3/8	2.830	.556
99-53800-014	PLI 22-24-229.5	1 1/2	3.100	.586

Following are precautions to be observed in any washer installation.

Flat close tolerance plain washers are not to be substituted for other type washers.

Flat close-tolerance countersunk washers are intended for use under bolt heads which have a fillet between head and shank.

All aluminum alloy washers such as AN960PD, having chemical surface treatment, alodine, anodize, irridite, etc, are dyed red on the entire surfaces and edges.

All AN960D washers having no chemical surface treatment have only the edges colored yellow. This type washer is used in electrical and static bonding conditions where metal-to-metal contact is necessary.

To provide a means of identification after installation, all NAS 143 Type C and MS 20002 countersunk washers (all sizes) are dyed blue. Plain type NAS 143 and MS 20002 are not dyed.

Care is to be exercised in the selection of bolt and screw grip lengths so that the use of washers will be minimized (see fig. 3).

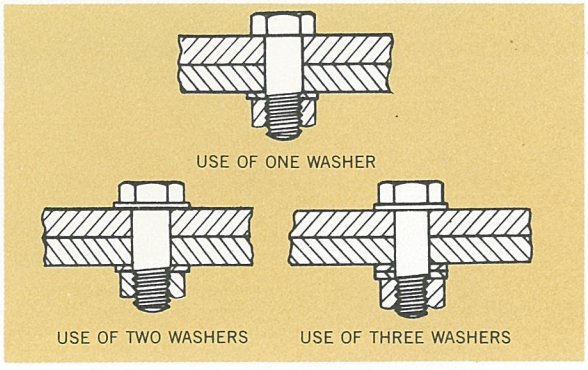


Figure 3. Use of spacer washers.

Delta P Filter Inspection

...Utility pump failures can be reduced by a daily check of the pressure drop indicator buttons...

Reprinted from McDonnell Aircraft *Field Support Digest.*

DAILY INSPECTION of the Delta P (pressure drop) indicator buttons on certain utility hydraulic filters is one of the most important steps in maintaining system reliability. It is a quick and easy check, and yet it is being widely neglected. Maybe one of the reasons for this neglect is simply a lack of familiarity with the indicators and their location; another reason may be a lack of understanding as to why this required check is so important. In the hope that more information will help out in both of these cases, we'll discuss as clearly as we can what a Delta P indicator does, how it does it, what filters have them, why they have them, where to find them, and finally the possible consequences of allowing these filters to clog up by neglecting to inspect them. That sounds like a lot, but it is really pretty simple. In fact, it's already in the handbooks and work cards; but by putting it all together in one place, we can give it some additional emphasis and perhaps clear up a few questions.

First of all: what does a Delta P indicator do? It is a device built into the filter housing that senses the differences between input and output pressures to and from the filter. The restricting action of the filter element causes the ouput pressure to be lower than the input. This pressure drop, called "Delta P" in engineering language, naturally grows larger as the filter element clogs up and offers more restriction to flow. When the pressure drop reaches a predetermined level, the indicator pops up.

The pressure drop value that triggers the indicator is less than that required to open the bypass valve, if the filter has one. This is the main purpose of the indicator; the button will usually pop up a flight or two before the bypass opens. This gives you the opportunity to change or clean the filter before it begins to pass contamination particles downstream to the rest of the system. To take advantage of this opportunity, however, you *must* check the indicators daily.

Some filters with Delta P buttons do not have bypass valves. When they clog up, they partially block the flow of hydraulic fluid, with the consequences that we'll discuss later. The button will pop before blocking becomes excessive, however, so daily checks will enable you to avoid this condition also.

The way a Delta P indicator operates can be seen in the accompanying cross-section drawing.

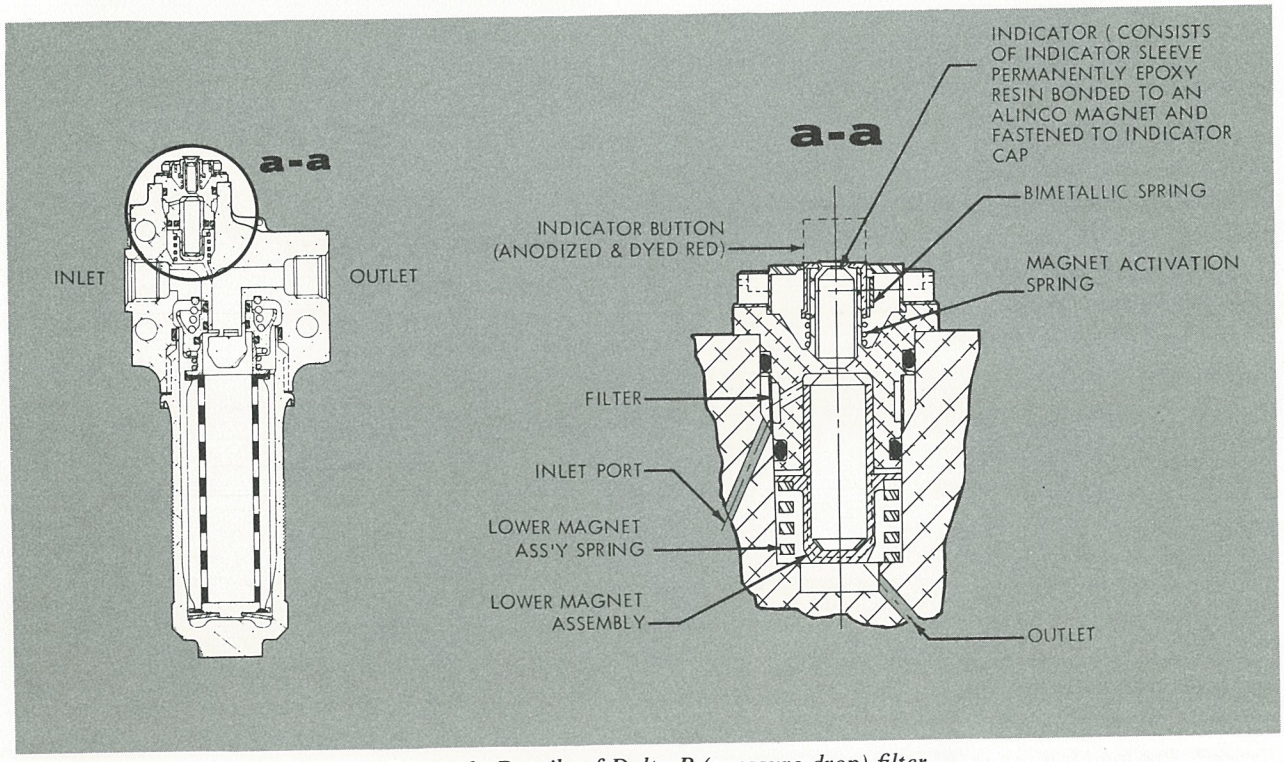


Figure 1. Details of Delta P (pressure drop) filter.

As you can see, it consists of two spring-loaded permanent magnets. The upper one carries the indicator button. The lower magnet, which is in the form of a free piston, is subject to filter inlet pressure on its top surface, and outlet pressure on its bottom surface. When the forces exerted on the lower piston by outlet pressure and the lower spring are greater than the force exerted by inlet pressure, the piston is held at the top of its travel. The small upper magnet is then within the field of the large lower one, and is held down, the magnetic attraction overcoming and compressing the small upper spring.

As the filter outlet pressure drops because of element clogging, the inlet pressure begins to overcome the forces of the outlet pressure and the lower spring, forcing the lower magnetic piston downward.

At a certain pressure differential (determined by the calibrated strength of the lower spring) the lower magnetic piston is forced down so far that the magnetic attraction is weaker than the upper spring, which then pops the upper magnet up, carrying the red indicator button with it. Note that the magnetic field acts through the solid housing—there is no hydraulic passage between upper and lower magnets.

The button will stay up until it is pushed down again manually. It will pop right up again, of course, if you push it in with system pressure applied and something being actuated to produce flow through the filter, unless you have remedied the pressure drop by installing a clean filter. If you push it down with no system pressure or flow, it will stay down. This brings up a point of caution. Don't push the button down under these conditions unless you have changed the filter element; if you do, everything will appear all right to the next man who makes the next check. But it's *not* all right; the filter is still dirty, and the button will pop up again when an engine is started and the system begins to work. But nobody will see it until the next check.

There is one justifiable exception to this rule. If you have a good reason to suspect that a button has popped just to annoy you, like maybe you put in a clean element only yesterday, push in and let it go one more flight. If it stays down, OK. If it pops up again, change the element and look for the source of contamination.

One filter in particular has been prone to do this: the aft systems return filter (locate it on the schematic and pictures in this article). To protect the transfer pumps, it is set to pop at a lower value than the others. Surge pressures from tail hook extension and other hydraulic mysteries sometimes make it pop although the filter is clean. MAC engineering is working on an improvement to stop these false alarms. Don't let any misbehavior of this one button shake your faith in the others. They're a very reliable and convenient indication of the condition of the utility hydraulic system.

One more mechanical detail should be noted before we leave the cross-section view. There is a temperature-sensitive bi-metallic spring that prevents the popping up at low temperature, when high fluid viscosity would give a false pressure drop. Above 80°F it moves out of the way. This is filter housing temperature, not ambient temperature. The hydraulic fluid quickly heats up the housing when the system is operated.

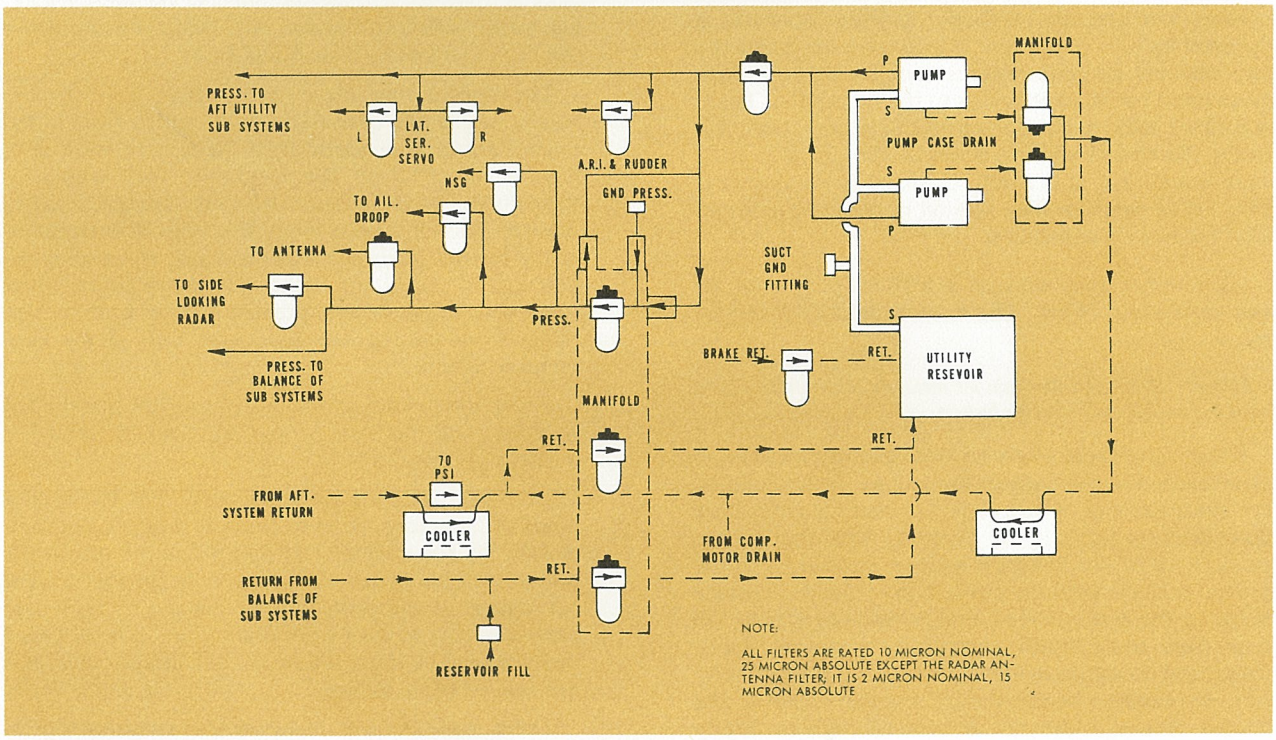


Figure 2. Location of filters within a system.

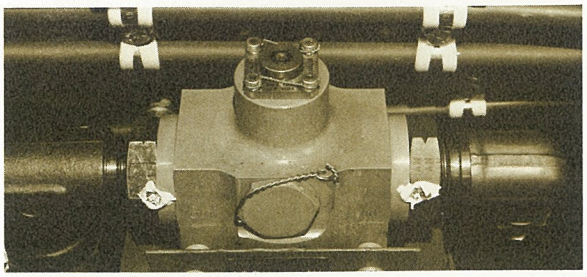


Figure 3. Pressure filter.

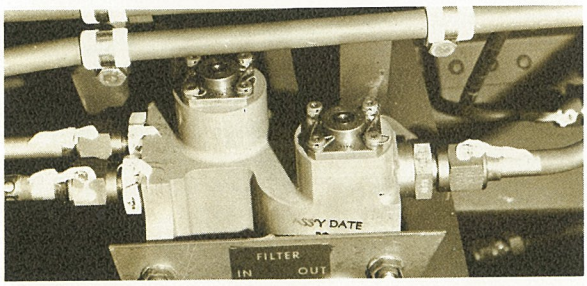


Figure 4. Case drain line filters.

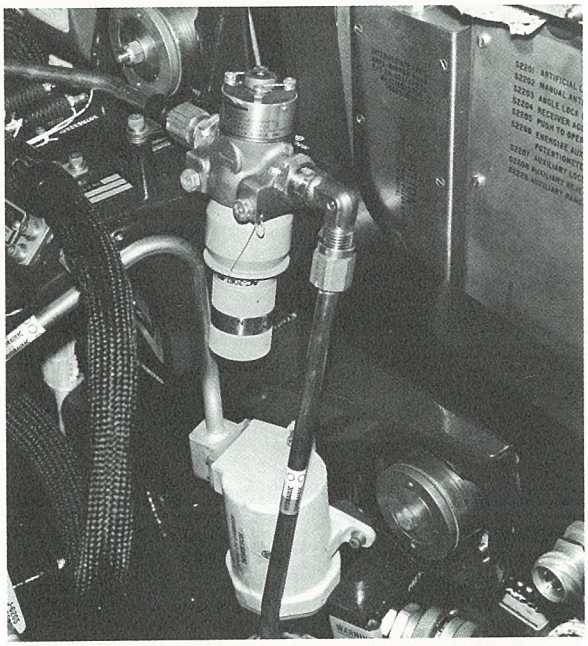


Figure 5. Pressure filter.

Now for the location and purpose of each filter having a Delta P indicator. Their system location is shown in the schematic. Their physical location is covered by the photos.

Let's consider the pressure filter first. This is a bypass filter, so if it clogs up, any contamination particles coming from the pumps go on out into the entire system. You can see it through a bullseye door that is fastened by only one screw. If you have to change the filter element, go in through the door just below it. This gives more convenient access to the filter bowl. There is a handy trick to installing new safety wire. Attach it to the filter bowl while it is out of the aircraft, of the same length and in the same position as the old wire. This saves much fiddling around in cramped quarters after the bowl is reinstalled.

Also immediately associated with the pumps are the two case drain filters. These have indicators but no bypass valves.

Editor's Note: On Convair jet airliners, case drain filters have bypass but no indicator button.

Clogging of these filters and the resulting increase in flow restriction can damage the pumps. To understand the consequences of this, consider what the pump case fluid does for us: it is the hydraulic fluid that passes through all of the designed-leakage clearances in the pump: past the pistons, through the balance-pressure holes in the piston shoes, and is discharged into the case from compensator operation. It washes, lubricates, and cools the working parts of the pump; therefore, it needs to be constantly drained, cleaned, and cooled. Hence, as the case drain filters begin to clog up and offer more flow restriction, the pump case pressure builds up. This has a bad effect on the running shaft seal and the gaskets of the pump case. If it builds up high enough it may blow a gasket or the shaft seal, losing the utility fluid and causing system failure. In fact, this has been a fairly common cause of system failure. In addition, high case pressures reduce the case drain or cooling flow by causing oil in the pump case to route back to the suction port via internal leakage paths within the pump. Also, clogging can cause the filter element to distort and twist.

The reason that these filters don't have bypass valves is that the case drain fluid carries most of the normal pump wear particles; if these were allowed to bypass the filter to the reservoir, they would go through the reservoir and back to the pumps, creating the well-known vicious circle that ends in destruction of the pumps. They must be positively stopped somewhere, and that place is the case drain filters. More important, these filters prevent debris from a sick pump from ruining the good one, thus giving two-pump reliability.

These case drain filters are physically manifolded together, and the buttons can be checked through a bullseye in door.

PREVENT PUMP FAILURES. To point out the importance of daily inspection of these two filters, approximately 90 per cent of the pump failures are in the utility system. Types of failures indicate that a large percentage of the problems are caused by high case pressures and loss of case drain cooling flow. Good maintenance on these filters can definitely correct this and reduce pump failures.

Three more Delta P filters are also mounted together. One is the pressure filter that cleans ground cart

pressure fluid before it enters the aircraft system. This button can be a help in analyzing the source of suspected contamination. If it is popped and the aircraft pressure filter button is not, contamination is most likely coming from the ground carts. If this is ignored, the aircraft system can become contaminated since this is a bypass filter.

The other two are return filters, to clean up the fluid coming back from the utility subsystems before it gets to the reservoir (and from there to the pumps, where dirty fluid would produce the self-generating wear cycle we've already described).

These three filters are easily accessible for checking and element replacement.

That leaves only one more Delta P filter that is not a daily check item. This is the pressure filter that gives extra-fine cleaning to fluid for the radar antenna motors. This can easily be seen, and reached, when the radome is open. Inspection and maintenance of this filter is normally performed by radar personnel. It is a non-bypass filter; excessive clogging will slow down antenna motion.

It isn't much trouble to check these buttons, and it can save a lot of trouble in flushing, pump replacements, and other types of trouble-fixing. Remedial maintenance is always more trouble than preventive maintenance.

And—a daily look at the buttons just might save a great deal of trouble for some pilots and crash crews.

Microbe-Killing Biocides

BIOCIDES that prevent damaging fungus or microbial growths in jet fuel tanks have been developed.

Microbial contamination of jet fuels with resultant corrosion in integral fuel tanks is a problem facing all operators of jet and turbojet aircraft, as well as the petroleum industry. Many articles have been written on the subject (see Convair Traveler, January/February 1963), and research projects have been instituted to help combat the problem.

Jet fuel (JP-4 and kerosene) is relatively water-free when it leaves the refinery; it picks up water and foreign materials as it is conveyed from one area to another. It takes only a small amount of water to promote growth of bacteria in a fuel tank and, once fungus has started, it is not easy to remove. In some cases, it has become necessary to drain and scrub out the tanks. This is a costly procedure and not completely effective, since fresh sources of bacteria and moisture can enter the tanks and start the procedure all over again.

Microbial activity in aircraft fuel tanks and in fuel storage systems has been associated with fouling of filters; erratic operation of fuel quantity indicating systems; and most important, corrosion of wing tank area.

Since it is virtually impossible to keep water out of fuel handling systems, and it is in the water that microorganisms live and multiply, a biocide was needed that would kill the rapidly growing bacteria and tenaciously clinging molds that can obstruct fuel systems and contribute to corrosion.

Microbe-killing biocides that prevent growth of matlike fungus have been developed by the Standard Oil Company (Ohio) and the Phillips Petroleum Company.

BIOBOR JF, developed by the Standard Oil Company (Ohio) and manufactured and sold under a licensed agreement with the U.S. Borax & Chemical Corporation, is a special formulation of organoboron compounds which are soluble in the fuel and which will disinfect both the fuel and any water phase present.

The effectiveness of BIOBOR JF, as a biocide for the control of microorganisms in jet aircraft, was proved through tests made on a Convair 880 and other commercial and business aircraft. These tests were conducted in cooperation with the Federal Aviation Agency at the Aeronautical Center in Oklahoma in the months of January through May 1965.

In these tests, wing tanks and fueling practices were monitored. Records were kept on fueling, additive treatment, location of fuelings, sample analyses, and engine overhaul.

These tests showed that BIOBOR JF killed all vegetative microorganisms in turbine fuel, under a variety of storage conditions. Fuel filters were found to be serviceable six times longer because of the disinfected fuel, and there was a noticeable reduction in carbon deposits.

It was found to be compatible with all parts and components of the aircraft fuel systems and engines tested. Complete disinfection of the fuel was attained.

No adverse effects were found with corrosion of fuel system parts with compatability of top coatings, sealants, and elastomeric materials. BIOBOR JF did not adversely affect water separation characteristics, fuel thermal stability, or other specification tests.

An added dividend in the use of BIOBOR JF is that it protects system components against fuel icing. Operators have reported that the incidence of fuel filter heater cycling had been reduced to nil after continuous use of BIOBOR JF-treated fuel.

Addition of BIOBOR JF to liquid hydrocarbon fuel is made in amounts ranging from 135 to 270 ppm. The higher level is recommended initially in order to attain

total disinfection more rapidly in the newly treated system. After a system has been disinfected, the lower level of treatment is generally sufficient to maintain lethal concentrations.

Both JP4 and kerosene absorb more water than does gasoline. When this water freezes, water droplets combine with the fuel to form a frozen substance referred to as "gel." This gel has been known to contain as much as 20% water. When carried from the tank into the fine filters and other components of the aircraft fuel systems, this gel fouls filters, fuel screens and fuel capacitance gages, obstructing flow of fuel to the engines and causing power loss.

Phillips Petroleum Company has developed a fuel additive, PFA 55MB, that protects against fuel icing in flight and on the ground when small amounts of water freeze out of the fuel at low temperature.

PFA 55MB prevents icing of entrained water by migrating to and becoming blended with this water, inhibiting the formation of ice crystals.

The biocidal effect of PFA 55MB in fuel has become even more important than its ice inhibiting properties. When 55MB is used in concentrations of 0.05 to 0.15 volume percent in fuel, it will kill rapidly growing bacteria and fungi, and eliminate their damaging effects.

The preferred method of blending BIOBOR JF or PFA 55MB in the fuel is by metered injection directly into a flowing stream of fuel. If necessary, the additive can be satisfactorily batch-blended in water-free mix tanks. If batch-blending is used, the biocide should be introduced into the tank while it is being filled. To ensure uniform dispersion throughout the hydrocarbon phase, the biocide should be added when the tank is approximately one-half filled.

All containers for storage of biocides should be clean and dry to preclude contamination. Lids should be kept tightly sealed because of the compound's hygroscopic nature (ability to absorb and retain moisture). Storage tanks and drums of iron or steel may be used, since the additives are non-corrosive.

FAA approval of BIOBOR JF and PFA 55MB enables operators to use either of these products as a combination anti-icer and microbe killer. BIOBOR JF can be obtained from the U.S. Borax & Chemical Co.; PFA 55MB can be obtained from the following sources under their particular brand names:

Phillips Petroleum Co., PFA 55MB;
Dow Chemical, Jet Fuel Additive 98-2;
Houston Chemical, Anti-icing Agent 20;
Union Carbide Chemical, UCAR Fuel Additive 500.

Good housekeeping, in conjunction with a biocidal additive, provide complete assurance against fungus and microbial slime. Good housekeeping includes daily draining of fuel sump areas to remove all water; frequent and regular inspection and replacement of filters and screens, and regular cleaning of storage tanks.

ENGINEERING CLINIC

TOWING PRECAUTIONS
Convair 880/880M/990

When towing or pushing the Convair jet airliners, the nose landing gear steering linkage should be disconnected. This is done by pulling the "tee" handle to release the torque links.

The time required to reassemble the linkage takes only seconds and will preclude delays that could result from a broken linkage.

When reassembling the quick-disconnect fitting, care is to be taken to assure proper alignment of the nipple and socket ends. The red-band indicator shows the proper coupling alignment.

ACCESSORY GEARBOX LUBRICATION
Convair 600/640

Several Convair 600/640 operators have reported hydraulic pump and accessory drive gearbox spline wear. Investigation has revealed that wear was due to lack of lubrication.

The accessory gearbox drive is to be lubricated during installation of the pump. Both Convair and Dowty Rotol suggest periodic inspection of all gearbox drives to assure sufficient spline lubrication.

Unitemp 500 grease, or equivalent, with a 50% mixture of graphite, is suggested for spline lubrication.

LUBRICATION OF FLIGHT CONTROL BEARINGS

Aeroshell 7 grease meets the requirements of MIL-G-23827A and is, therefore, an acceptable substitute for grease per MIL-G-7421A, which was originally specified for the flight control system. Operators may use Aeroshell 7 at their discretion.

MLG/NLG SHOCK STRUT SEAL INSTALLATION

Service life of the static and dynamic seals in the main and nose landing gear struts of Convair-Liner and Jet Airliner type aircraft can be appreciably increased with installation of a dual seal configuration.

The new two-piece camming type backup seal, used with a standard O-ring, overcomes the problems associated with conventional O-ring strut seals.

This cam seal, developed by W. S. Shamban and Company, maintains zero diametral clearance at all times, regardless of changes of clearance due to variations in O-ring pressure and distortion, resulting from high torque loads. Consequently, it provides complete protection for the O-ring, preventing O-ring extrusion, nibbling, and spiral failures.

Since it is a split ring type, the Camseal is installed as quickly and easily as a backup ring. Both rings are color-coded for simple identification, and can be installed in horseshoe fashion without requiring removal of the lower part of the landing gear.

Camseals fit into the two standard backup ring grooves without any rework of the gland; spare seals may be carried within the strut for emergency replacement (see illustration).

The camseal is made of Turcon, a wear-resistant Teflon material that is compatible with all hydraulic fluids; it is self-lubricating, non-scoring, tough, and resilient.

These seals have been extensively tested in commercial jet service, airline operators reporting that they extend shock strut service life by thousands of hours.

Other advantages of these seals are:

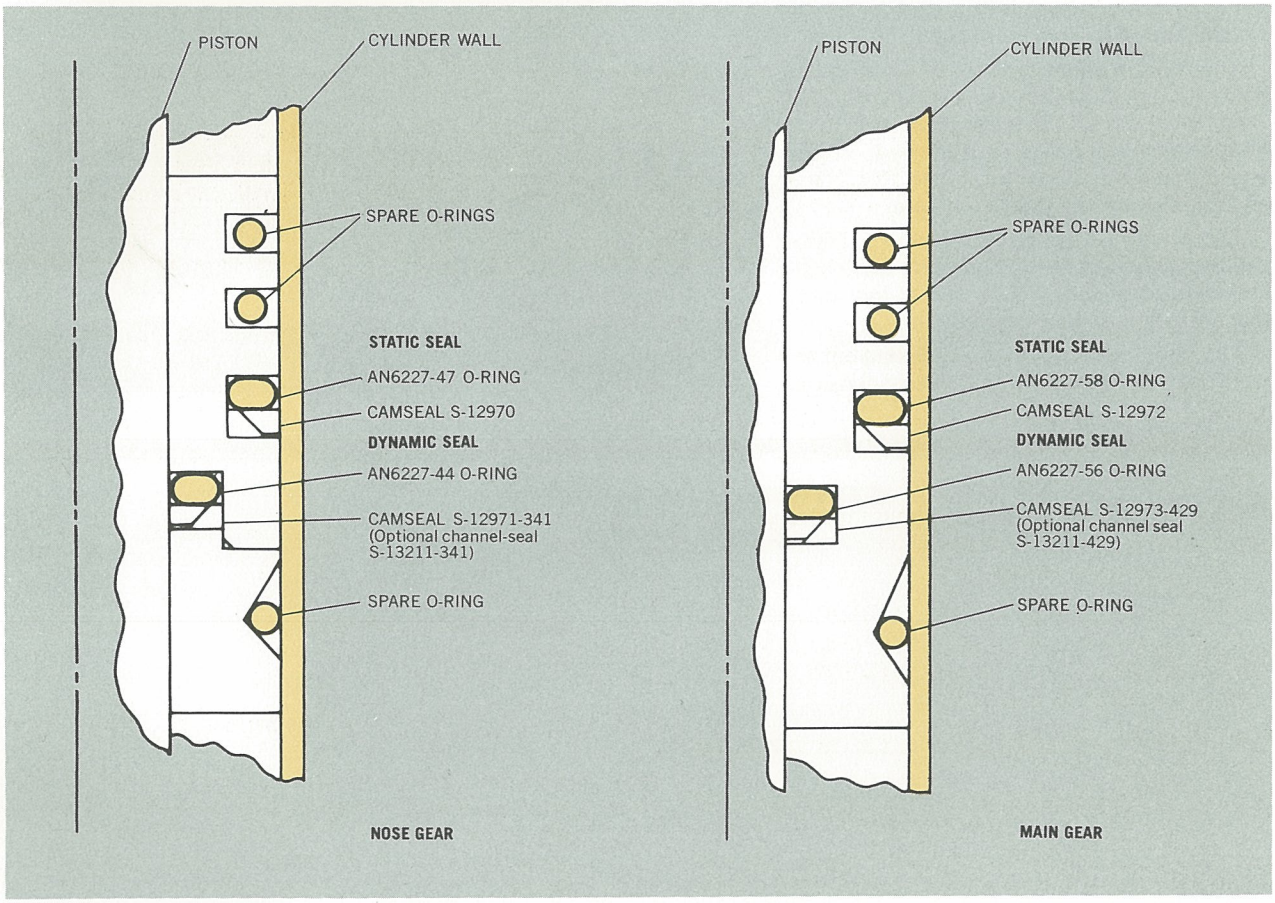
No alteration of the groove is necessary.

Positive sealing is provided.

Savings are effected in down time, labor and parts; loss in revenue is minimized.

Parts are individually packaged for protection and for the operator's convenience in stocking.

Parts may be ordered for immediate delivery through W. S. Shamban and Company, 11543 W. Olympic Blvd., Los Angeles, California 90232. Numbers of seals for Convair-Liner aircraft are shown in the illustration; 880/880M/990 seal replacement numbers are given in Convair jet airliner Newsletter Vol IV, No. 7, dated 1 September 1963.



Convair to Build Buoy Data System

A CONTRACT to outfit its large navigational buoy with an oceanographic and weather data system has been awarded the Convair division of General Dynamics.

The data system equipment, to be furnished and installed by Convair, will permit collection, storage, and transmission of oceanographic weather information. It will measure wind speed and direction, air temperature, and barometric pressure; sea water temperature, pressure, salinity, conductivity, speed, and direction.

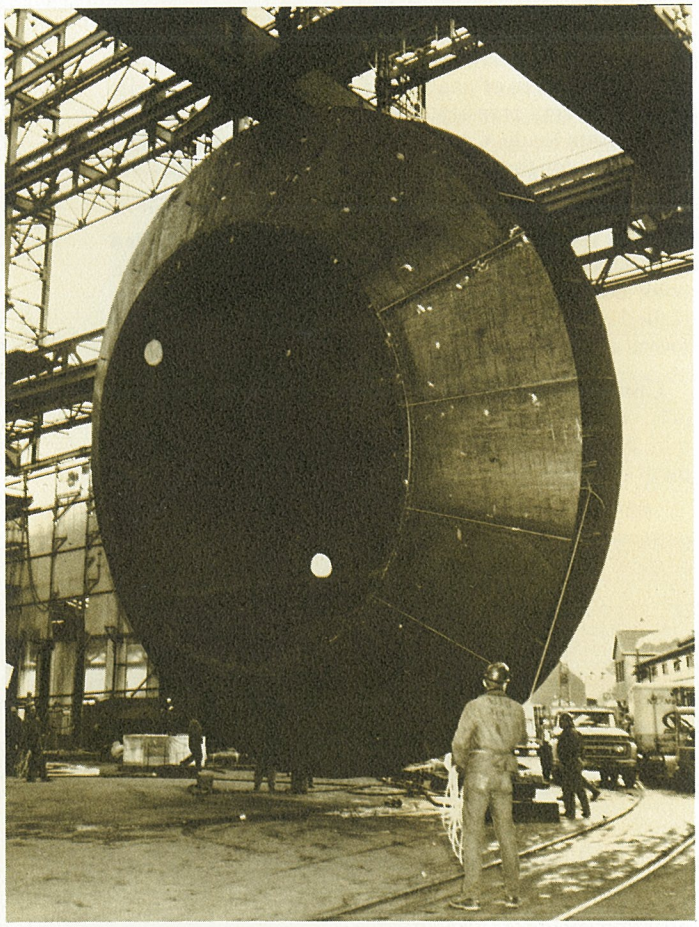
The buoy will replace a Coast Guard lightship, which is stationed off Sandy Hook, New Jersey, to guard the approach to New York harbor.

It is anticipated that these buoys will replace all lightships in the future. Many of them are approaching obsolescence and are costly to maintain and operate.

The 40-foot diameter hull of the buoy is being built at Groton, Conn., by the Electric Boat Division of General Dynamics. The buoy superstructure, being built by Convair, will be shipped from San Diego to Groton and mated with the steel hull there.

The buoy will be equipped with a 5000-candlepower light, a fog horn, and radio beacon. Also furnished will be the 32-foot mast that will sit on top of the buoy.

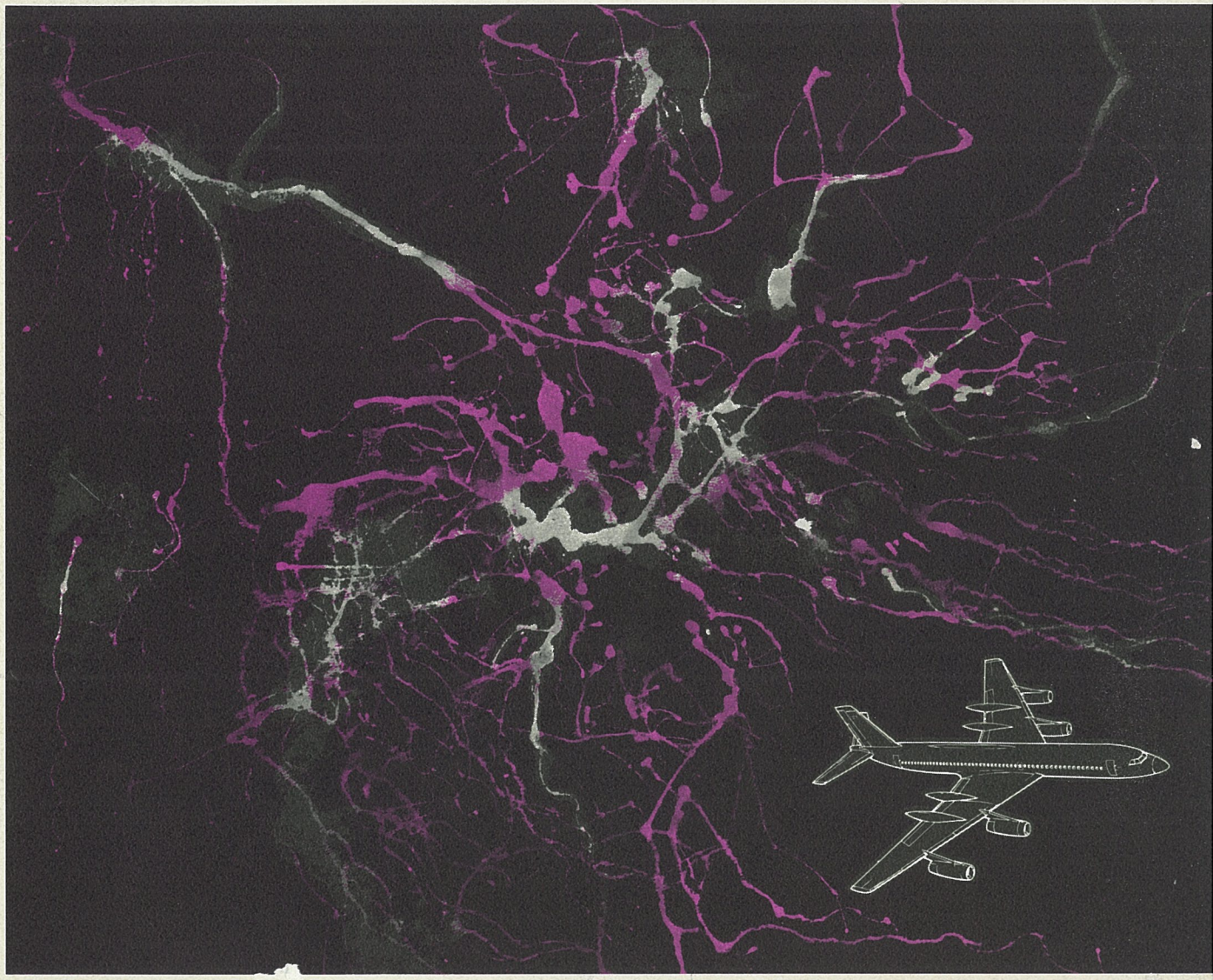
The buoy, including hull, mast, and equipment, was designed by the Convair division.



GENERAL DYNAMICS
Convair Division

VOLUME XIX NUMBER 3 SEPTEMBER/OCTOBER 1967

Convair Traveler



In This Issue: Null Field Static Dischargers
A New Method for Removing Surface Corrosion
Engineering Clinic

VOLUME XIX NUMBER 3 SEPTEMBER/OCTOBER 1967

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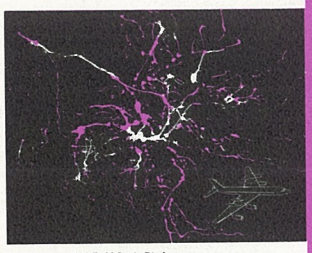


OUR COVER

Harvey Adams, artist, illustrates the electric charges acquired by an aircraft from bombardment of airborne dust and precipitation particles, and the release of these charges through use of static dischargers. Actually, passengers are unaware of this continuous buildup and discharge, since there is no flash or noise that is apparent in the cabin.

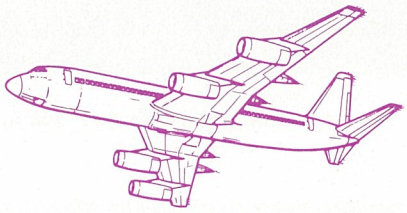
Convair Traveler

IN THIS ISSUE

A digest of operation and service published bimonthly by the Technical Publications Section of the Convair Division of General Dynamics, primarily for the interest of Convair operators.

CONVAIR DIVISION OF GENERAL DYNAMICS

NULL FIELD STATIC DISCHARGERS . . .



RADIO INTERFERENCE, caused by an aircraft passing through areas of precipitation static, is eliminated by installation of null field static dischargers, a product of Granger Associates.

Low-frequency radio receiver noise and the resultant restricted range is usually caused by precipitation particles, dust, and other objects that impinge on the aircraft, depositing electrons, and producing positively charged ions. The friction that occurs when two dissimilar materials contact each other and then separate —as when hair is combed, or when the aircraft flies through precipitation—causes arcing, or corona between the aircraft and atmosphere, and the aircraft tends to acquire an electrically charged (unbalanced) condition.

Corona, often observed by pilots as purple arcing, and referred to as St. Elmo's fire, is the discharge of electrical current into the surrounding air when an electrical field at the object surface exceeds a critical value.

Corona discharges occur as very rapid, short pulses of current, which are picked up by receiving antennas and conducted into the radio receivers. These discharges produce a noise spectrum containing considerable energy at low radio frequencies. Unless controlled, they blanket desired signals.

Electrical charges acquired by the aircraft, and the resultant corona discharges cannot be prevented; it is possible, however, to modify the fields in the discharge range to provide points that will correspond to zones of zero radio frequency, coupled with respect to the susceptible antenna system. This is the function of the null field dischargers, which discharge the aircraft, preventing the discharge coupling to the antenna and, hence, into the radio receiver.

Installation of null field static dischargers on Convair 880 aircraft increased the maximum usable range of the ADF on low-power markers from 11 miles without dischargers to 43 miles with dischargers. Similarly, the maximum usable range on a marker of somewhat higher power was increased from 90 miles to 250 miles.

Convair-Liner type aircraft have cotton wick dischargers. With the increased speed of Convair 600/640 aircraft, and the charge buildup produced by turbine engines—both contributing to the increase in static charging rates—operators may wish to replace their cotton wick dischargers with the null field type. Null field dischargers may also be installed on Convair 240/340/440 aircraft. They are installed in the same locations as the wick type dischargers.

Model 610 rod-type dischargers (figure 1A) are mounted on trailing edges of wings, elevators, and rudder, near their extremities. On the Convair 990, they are also installed on the anti-shock bodies. The principal discharge current is carried by these dischargers.

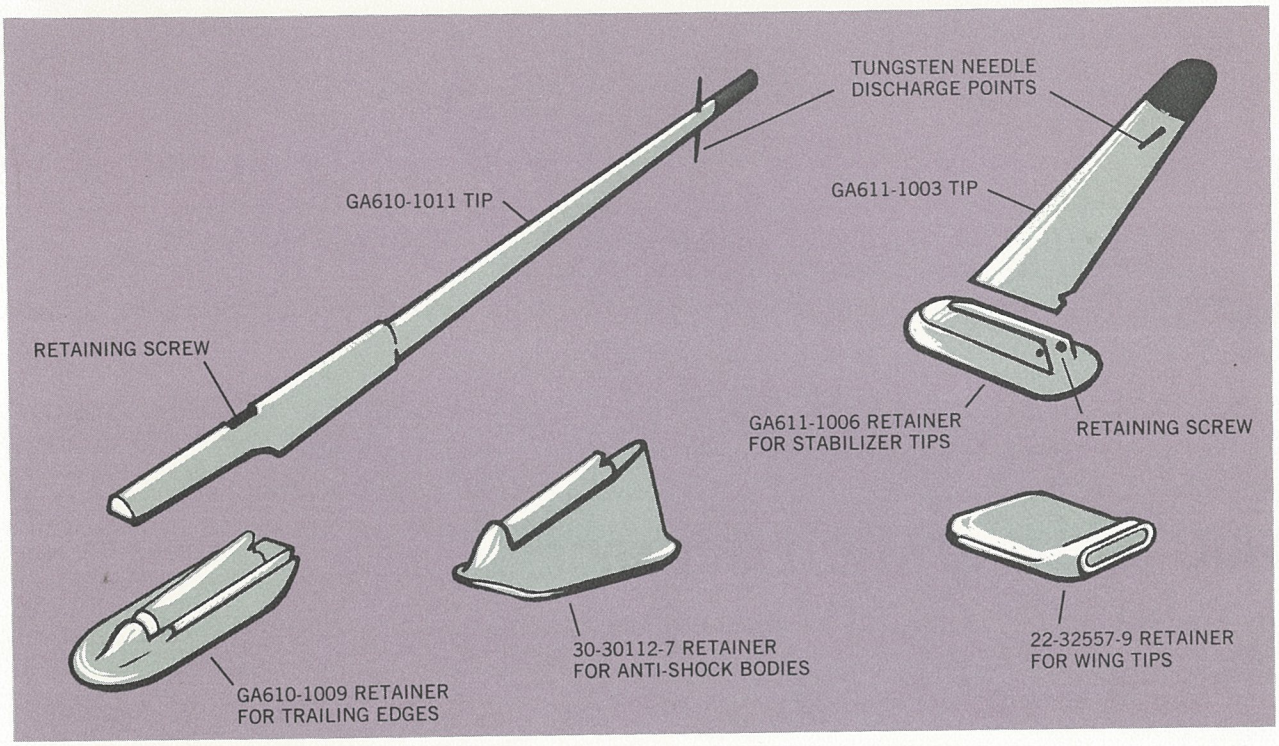


Figure 1. Rod and blade type null field static dischargers.

The Model 611 blade-type dischargers (figure 1B) are mounted on the wing and empennage tips. These units carry the remainder of the discharge current. Their locations in the low-pressure vortex regions create a space-charge shield which helps to prevent corona from occurring from the aircraft structure itself.

The net effect of a complete installation is to reduce corona threshold potential of the aircraft by a factor from 6 to 15. The result is to cause corona to occur from the decoupled dischargers rather than from points on the aircraft which are more highly coupled to the antennas.

Sharp tungsten needles in the discharger extend from an area near the tip and at right angles to the body. The tip radii of these needles are kept very small so that the corona threshold voltage will be correspondingly low. This feature assures that the discharge will occur only at these control points.

There are 35 dischargers installed on Convair 880 and 880M aircraft. The 990 has 40. Distribution of these dischargers is shown in figures 2 and 3.

The minimum number of dischargers that can be missing has been established by service experience. If more than four dischargers are missing, the aircraft is not acceptable for dispatch.

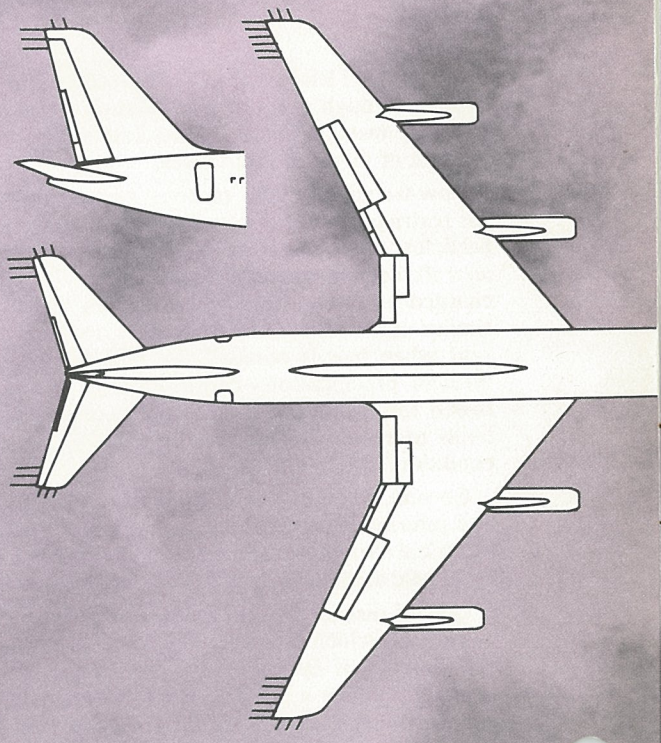


Figure 2. Discharger locations on 880/880M.

Less than four missing dischargers can also render the aircraft unacceptable for flight, since location and distribution are an important factor. But, first, let's look at figures 2 and 3 for basic distribution; then at the following table for allowable missing dischargers.

Area	Max Missing NFD-610	Max Missing NFD-611	Total Allowable Missing
Right or left wing	2	1	2
Right or left Horiz. Stab. (incl. elevator)	2	1	2
Vertical Stab. (incl. rudder)	1	1	1

Now, for the exceptions.

An aircraft is not to be dispatched with the NFD-610 rod-type static discharger missing from the wing tip cap trailing edge, from the horizontal stabilizer tip trailing edge, or from the vertical stabilizer tip trailing edge. (See figure 4 for these locations.)

If spare NFD-610 dischargers are not available for installation, any of the following dischargers may be removed and reinstalled in the critical positions (see figures 4 and 5).

Inboard-most discharger on wing outboard trailing edge.

Elevator trailing edge.

Lowest discharger on rudder trailing edge.

On Convair 990, the discharger on the inboard ASB trailing edge.

Convair 880 and 880M jet airliners may be operated without static dischargers installed, provided the information on ADF operation in the Flight Manual is complied with. This also applies to static dischargers over and above the amount noted.

Dischargers are installed in special mounting flanges attached to the airplane surface. They are designed to be adhesively bonded to the aircraft surface by means of an electrically conductive plastic adhesive.

The mounting base is designed so that riveting may be used in addition to the bonding.

Electrically conductive adhesive is required for all installations whether or not riveting is used. The adhesive is available from Granger Associates in one-ounce kits with hardener, or in one-half pound lots. The one-ounce kit contains sufficient adhesive for six to eight discharger installations and is the maximum amount one man can use during pot life of the mix.

During bonding, a heat clamp is required to prevent differential movement due to thermal expansion between the discharger base and the aircraft skin during curing. A hand hot-air blower is used on wing and tail tip surfaces which are curved.

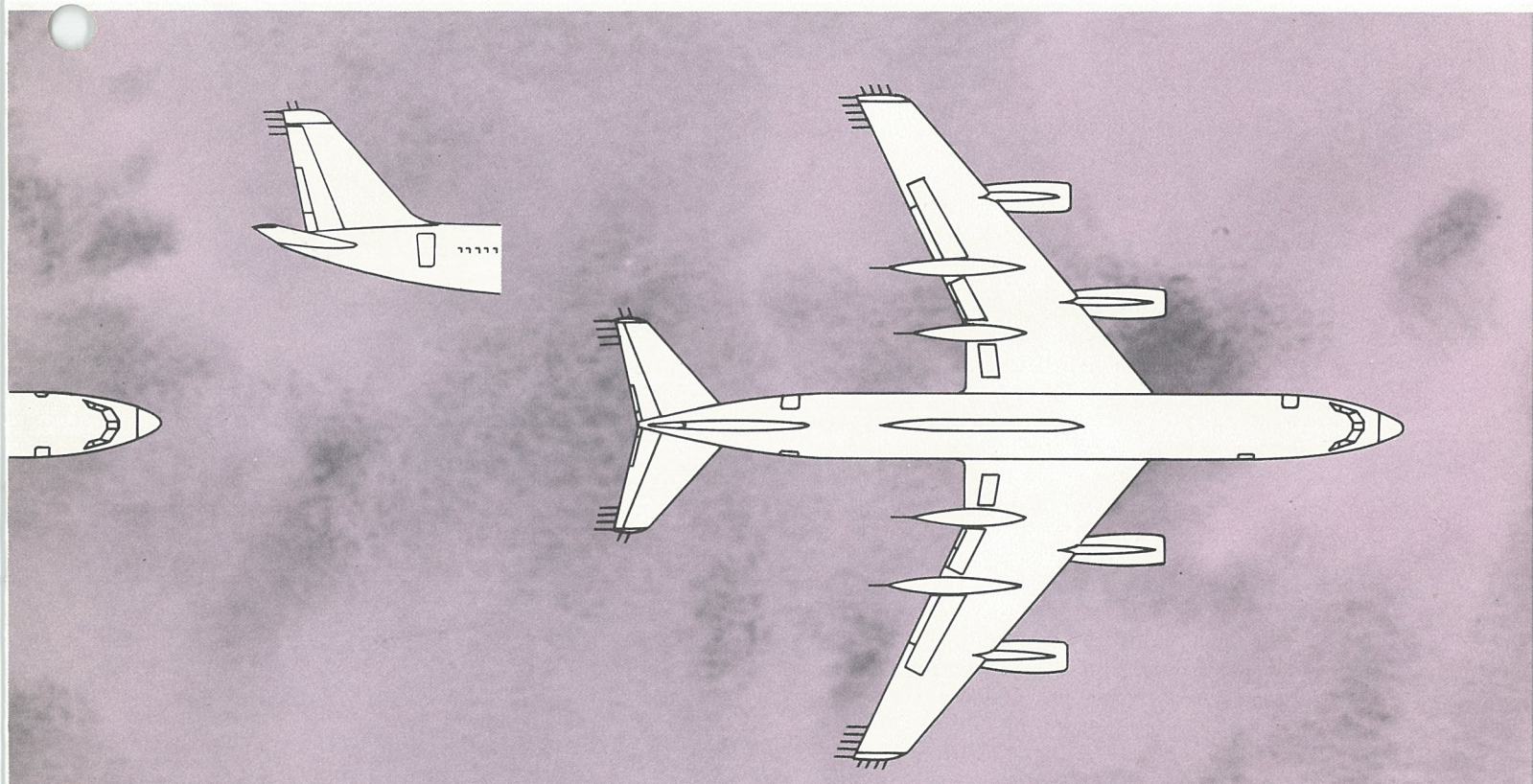


Figure 3. Discharger locations on 990.

METHOD OF ATTACHMENT

Surface Preparation

1. Mark location of all discharger bases on aircraft skin.

2. Remove paint, if any, from area to be bonded.

3. Degrease the bond area with grease-free solvent such as acetone, MEK, trichloroethylene, or ethyl acetate. Do not touch or otherwise contaminate the degreased area.

4. Scrub bond area with a thick paste of aluminum oxide and clean water. Scrub until all shine is removed and paste residue begins to turn gray-black from the finely divided aluminum particles. Do not allow paste to get too dry or chalky; it should remain moist but not wet after rubbing has begun.

5. Flush area with clean, grease-free water. Surface is clean if it will not break a film of water.

6. Thoroughly dry surface with air heater.

7. Apply adhesive within eight hours after aluminum surface has been cleaned.

Bonding Procedure

1. Mix all of Part B hardener with all of Part A resin in Granger adhesive Kit #610-1016. Mix thoroughly until mixture is smooth, being sure that all material in corners is adequately mixed. Pot life for one-ounce kit after mixing is one to two hours at 70°F. When using adhesive in bulk (½-pound lot), the weight ratio is 10 parts resin to 1 part hardener. Pot life is proportionately shorter.

2. Apply a thin layer of adhesive to aircraft surfaces, filling in cracks and voids.

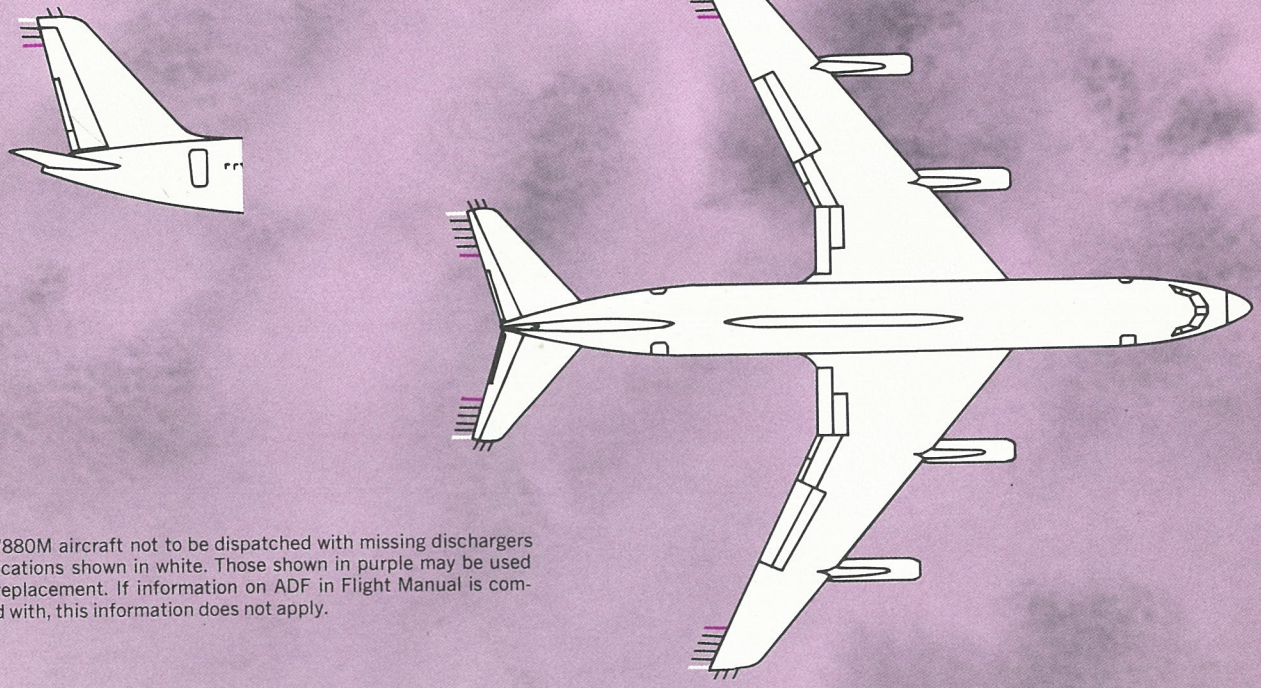
3. Remove metal discharger from plastic bag and, without touching mounting surface with fingers, apply thin coat of adhesive.

4. Attach mounting base firmly to aircraft surface. Twist with moderate pressure to assure thorough wetting and to squeeze out excess adhesive. Lift up mounting base to be sure of 100 percent adhesive contact. If voids exist, fill with adhesive. Replace mounting base on aircraft surface.

5. Remove excess adhesive with wooden or plastic tool but be sure there is a fillet around the entire edge of the mounting base. No cracks should be visible. Should aircraft surface not exactly conform to the mounting base, fill voids with adhesive.

6. Clean off excess adhesive with cloth dampened with trichloroethylene, acetone, or MEK. Remove excess adhesive before curing, and be sure not to wash away adhesive fillet.

7. Apply heat by placing a PVA film square over the mounting base and apply heat clamp over film. Apply



880/880M aircraft not to be dispatched with missing dischargers in locations shown in white. Those shown in purple may be used for replacement. If information on ADF in Flight Manual is complied with, this information does not apply.

Figure 4. Allowable missing dischargers on 880/880M.

firmly enough so that mounting base cannot slide. Use template to ensure correct alignment before cure begins. Set heat control to give bond line temperature of 200° to 225°F. Curing time is from 10 to 20 minutes. Cure is complete when adhesive cannot be indented with knife or screwdriver.

On a curved surface, use masking tape to hold base and PVA film covering firmly to aircraft surface. Apply heat with hot-air blower. Remove tape and film when cure is complete.

The adhesive is to be fully cured before the base is riveted.

After base is installed, electrical continuity should exist between the base and aircraft structure. DC resistance should be measured with a low-range ohmmeter. The resistance should be less than 0.1 ohm. *High-voltage resistance measuring equipment should not be used on an aircraft that is fueled.*

After adhesive is fully cured and continuity check is made, the elements (rods or blades) are installed, and the setscrews tightened. The rod or blade should be gently twisted or rocked. If it comes loose in its base, the setscrew should be tightened further to secure it in its mounting base.

When properly bonded and installed, interference due to precipitation static and engine exhaust gas charges is eliminated.

MAINTENANCE

There is very little maintenance required on null field static dischargers. Normally, maintenance consists of checking to ensure that a sufficient number of dischargers are installed and properly located, and that they are in good condition.

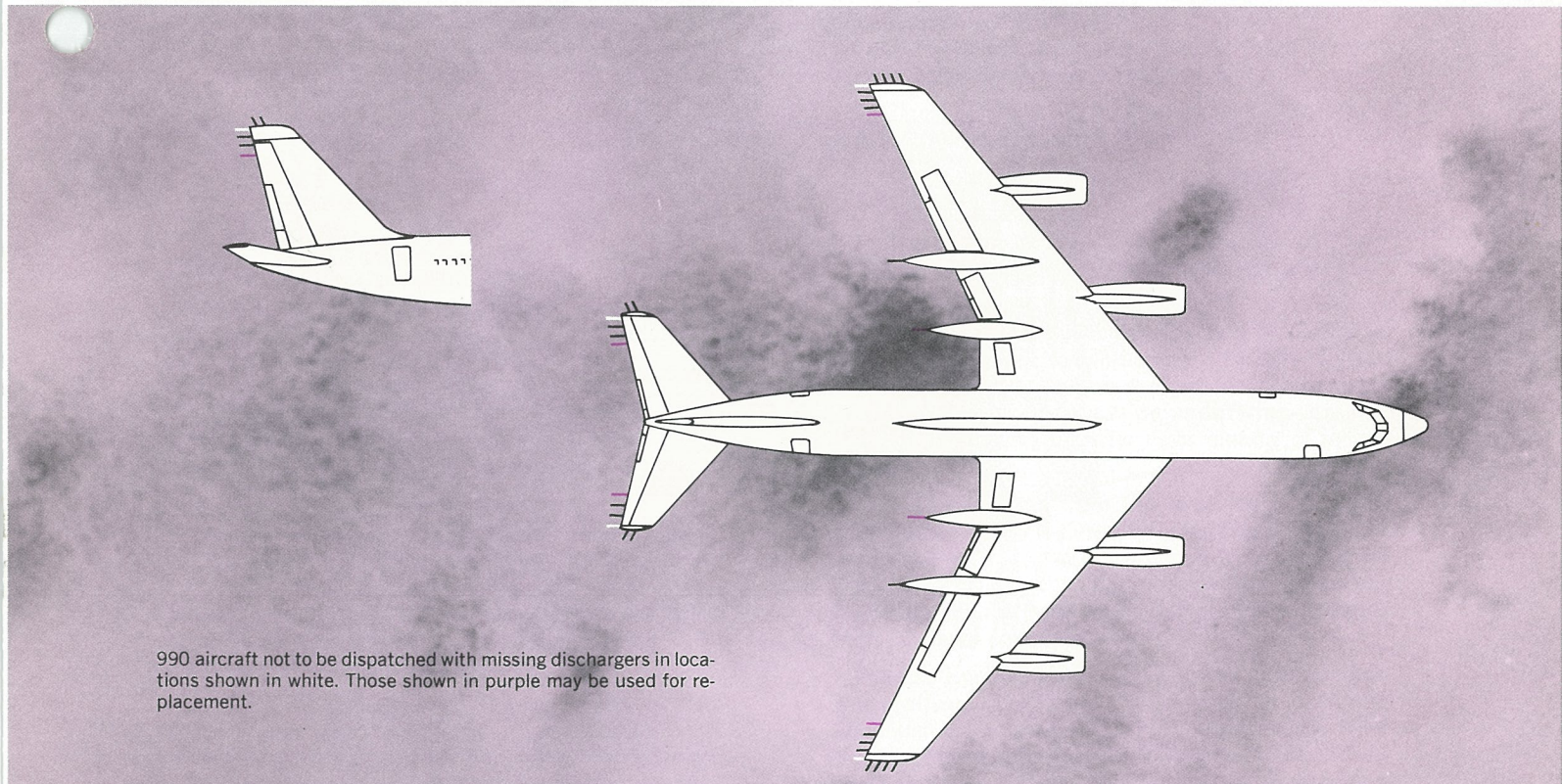
Dischargers that have blunted or bent needles are to be replaced. These needles act as low impedance discharge points and must be in good condition to effectively minimize the static charge.

If the conductive coating is worn away, dischargers should be replaced. If it is suspected that the coating is worn, resistance between the discharge needle and the aircraft should be measured. A high resistance ohmmeter or multimeter may be used.

1. Measure resistance of each static discharger between discharger pin and discharger base; tolerances are as follows: 8 to 50 megohms for NFD-610 (trailing edge rod-type dischargers); 5 to 30 ohms for NFD-611 (blade-type tip dischargers).

2. Measure resistance of adhesive bond between each discharger retainer and aircraft structure. Reading must be less than 0.1 ohm.

3. If any dischargers checked in steps 1 and 2 are out of resistance limitation, reinstall in accordance with the maintenance manual or the instructions under Method of Attachment.



990 aircraft not to be dispatched with missing dischargers in locations shown in white. Those shown in purple may be used for replacement.

Figure 5. Allowable missing dischargers on 990.

A NEW METHOD FOR REMOVING SURFACE CORROSION

Reprinted from News Letter/Flight Talk, a publication of Eastern Airlines, at request of attendees at Convair ATA Engineering and Maintenance Conference.

EAL has made a major breakthrough in removal of exterior aircraft surface corrosion through the use of nylon flap brushes and application of polyurethane paint. This process prevents the occurrence of corrosion and provides a painted surface whereby reverse thrust impingement and other deposits can be readily removed, leaving a "like-new" appearance.

Corrosion to most people means rusting of iron or ferrous metals, which is a reaction of oxygen with iron, but, there are many other types of metal corrosion. Underwing corrosion on aircraft with wing-mounted engines has long been a problem for EAL and other airlines. This type corrosion is caused primarily by reverse thrust impingement.

Deposits of combustion products, which include oxides of iron and vanadium, are highly corrosive to aluminum and the cadmium-plated surfaces of fastener heads. Exfoliation—a flaking of the metal—may also result. Penetration of the cadmium plate on fastener heads results in corrosion of the steel surface. When in contact with the aluminum surface, a potential for galvanic cell corrosion exists. If allowed to go unchecked, the action will penetrate the aluminum to a depth exceeding repair limits, necessitating application of a doubler plate or replacement of the skin panel.

Previous methods of removing corrosion from underwing and overwing surfaces employed the use of grit or vacu-blasting. These methods were not only time-consuming but also required considerable skill and care to avoid removal of good metal. These methods resulted in an incomplete corrosion removal from surfaces overcoated with paint. Later observation revealed corrosion growth beneath the paint, resulting in paint failure and rapid corrosion growth.

Early in 1966, Eastern reviewed methods and means of removing underwing and overwing corrosion. In view of their success in removing corrosion from aircraft control cables with the aid of a nylon pad impregnated with very fine aluminum oxide, they requested the 3M company to provide a nylon flap brush. The brush is composed of several layers of nylon pad bound together in the form of a wheel, which is powered by an air-drill motor. The flap brush is designed to permit ready removal of corrosion deposits without removal of any significant amounts of metal.

Once corrosion is removed, the brush merely provides a polishing effect without removing any significant amount of metal. The process consists of:

1. Removal of surface soil and contaminants with a cleaner, followed by strict controlled use of a mild brightener.

2. Use of nylon flap brushes for corrosion removal from fastener heads and adjacent skin panels.

3. Cleaning the treated surfaces with a non-flammable cleaner/degreaser.

4. Application of a pre-paint treatment to cleaned surfaces.

5. Application of polyurethane paint system, consisting of wash primer, polyurethane and gray polyurethane enamel.

Eastern Airlines, under the direction of Airframes Engineering, is utilizing this process for removal and prevention of corrosion on exterior aircraft surfaces. Evaluation of the process on underwing surfaces shows excellent results after eight months of inflight operation.

Hand pads, made from the same material as the flap brushes, are being used instead of steel and aluminum wool for removal of corrosion from various aircraft and engine parts. The pads are more effective than aluminum or steel wool and preclude the possibility of metal contamination.

Eastern Engineering has developed a clear Alodine-Polyurethane System for application on unpainted aluminum surfaces for corrosion control. In July 1966, Eastern Engineering requested Douglas Aircraft Company to apply a clear Alodine coating to unpainted DC-9 control surfaces in lieu of a wax coating for prevention control. Douglas is now complying with this request.

ENGINEERING CLINIC

STABILIZER ATTACH FITTING REBUSHING LIMITS

Convair 340/440/640

Rebushing limits for the vertical and horizontal stabilizer attach fittings on Convair 340/440/640 aircraft should be within the tolerances given in the following tables.

		MINIMUM OVERSIZE PERMISSIBLE			FIT: BUSHING TO FITTING		
		REAM	BUSHING OUTSIDE DIAMETER	INSIDE DIAMETER	MIN	MAX	OVERSIZE PERMISSIBLE
FORWARD	STABILIZER	0.6870 +0.0005 −0.0000	0.6885 +0.0000 −0.0005	0.6250 +0.0005 −0.0000	0.0005	0.0015	0.8130
	FUSELAGE	0.6870 +0.0005 −0.0000	0.6885 +0.0010 −0.0005	0.6250 +0.0005 −0.0000	0.0005	0.0025	0.7490
AFT	STABILIZER	1.0000 +0.0005 −0.0000	1.0015 +0.0000 −0.0000	0.9375 +0.0005 −0.0000	0.0005	0.0015	1.1255
	FUSELAGE	1.0000 +0.0005 −0.0000	1.0015 +0.0010 −0.0005	0.9375 +0.0005 −0.0000	0.0005	0.0025	1.0615

TABLE I HORIZONTAL STABILIZER LIMITS

		MINIMUM OVERSIZE PERMISSIBLE			FIT: BUSHING TO FITTING		
		REAM	BUSHING OUTSIDE DIAMETER	INSIDE DIAMETER	MIN	MAX	OVERSIZE PERMISSIBLE
FORWARD	STABILIZER	0.8125 +0.0005 −0.0000	0.8140 +0.0000 −0.0005	0.7500 +0.0005 −0.0000	0.0005	0.0015	0.9380
	FUSELAGE	0.8125 +0.0005 −0.0000	0.8140 +0.0010 −0.0005	0.7500 +0.0005 −0.0000	0.0005	0.0025	0.8740
AFT	STABILIZER	0.6250 +0.0005 −0.0000	0.6265 +0.0000 −0.0005	0.5625 +0.0005 −0.0000	0.0005	0.0015	0.7505
	FUSELAGE	0.6250 +0.0005 −0.0000	0.6265 +0.0010 −0.0005	0.5625 +0.0005 −0.0000	0.0005	0.0025	0.6865

TABLE II VERTICAL STABILIZER LIMITS

GUST LOCK MAINTENANCE
Convair-Liner Type Aircraft

Recently, several Convair-Liner operators reported failures of the rudder gust lock plunger. Prior to the recent activity in this area, reports of plunger failures had been infrequent and were felt to be a result of excessive movement of the pin in a worn gust lock plate hole.

Movement of the rudder trailing edge with the gust lock engaged should not exceed 0.20 inch. This amount of looseness would be equivalent to 0.020 inch between the rudder gust lock plunger and the lock plate hole. This limitation may be even more important to maintain on 580 aircraft because of the increased rudder area on these airplanes.

Convair suggests that an inspection procedure be set up to detect rudder free play as it approaches ±0.10 inch. At this time, the condition can probably be corrected by replacing the plunger, lockpin wearplate, bearings, and/or other components as required.

On the aileron and elevator lockplate holes, a wear limit of 0.040 inch, measured as looseness between the plunger and hole, should be maintained.

Figure 1 shows gust lock geometry for the rudder, elevator, and aileron. The dimension given for the spring end of the plunger provides the optimum positioning for locking. Any amount of lockplate penetration is acceptable, however, as long as the straight sides of the plunger are in contact with the lockplate.

Accumulation of tolerances between the rudder lock plunger and bearing, and between plunger and lockplate hole largely determines free play of the trailing edge in service. Typical dimensions for the rudder, elevator, and aileron gust locks are 0.495 $\pm^{.002}_{.000}$ inch diameter for the plunger and 0.500 $\pm^{.002}_{.000}$ inch for bearing inside diameter. Since all service limits are based on trailing edge free play, it is recommended that these limits be maintained for overhaul purposes. Since allowable play is most important on the rudder, it is advisable to select fit parts at time of overhaul, if at all possible.

Convair has not established in-service wear limits between the shaft and bushings on the gearbox assembly, but the following dimensions are to be maintained when pressing the shaft retainer into the gearbox with wet primer. The inside diameter is 0.7177 $\pm^{.0015}_{.0000}$ inch. The diameter on the boss, which turns in the retainer, is 0.7172 $\pm^{.0000}_{.0010}$ inch. The inside diameter of the Q952-9-18 bushing, which is also pressed into the gearbox with wet primer, is 0.5625 $\pm^{.0015}_{.0000}$ inch. Diameter of the corresponding end of the shaft is 0.5610 $\pm^{.0000}_{.0010}$ inch.

Backlash tolerances for the gear and plunger have not been established. The average backlash for gear teeth of this type is about 0.004 inch. Because of accumulation of tolerances, this may vary from 0.001 inch to 0.007 inch.

Convair plans to make available a new rudder gust lock plunger (P/N 110-3040124-30), which is expected to increase service life of the unit. The flat spot on the pin end of the teeth has been eliminated, heat treatment has been increased, and the finish improved.

For price and availability of the improved plunger, interested operators may contact Support Contracts Department.

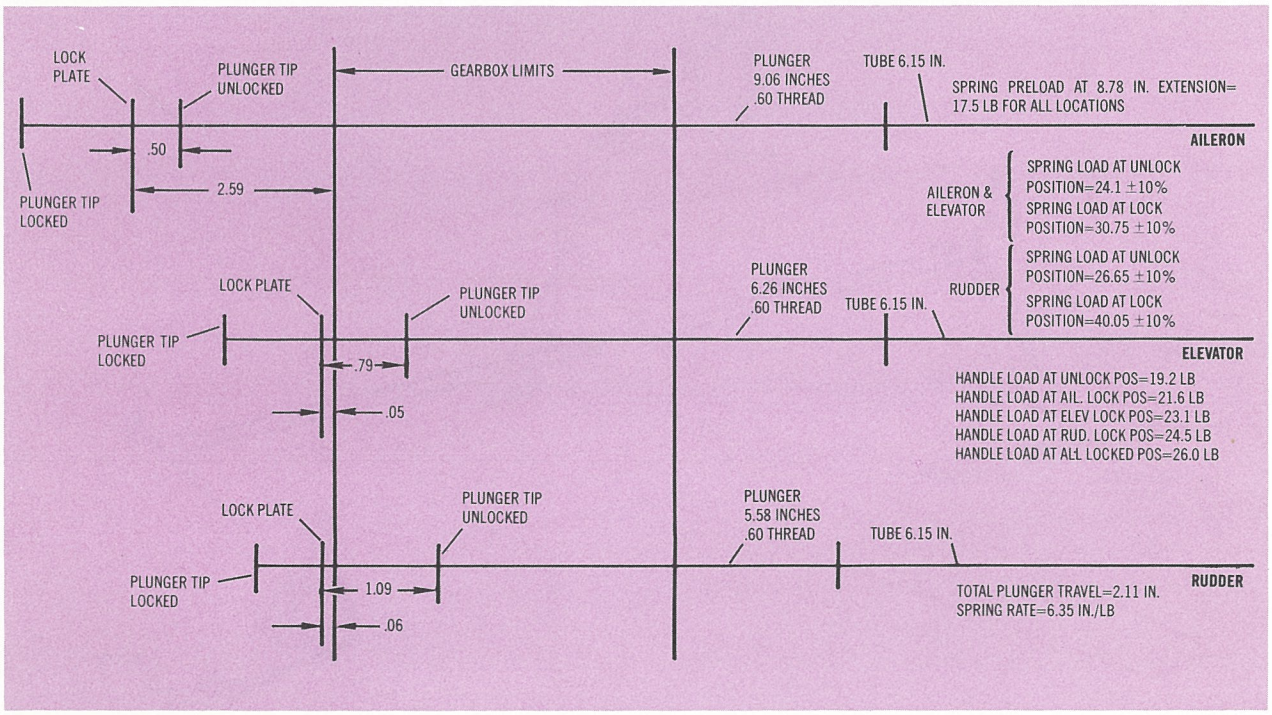


Figure 1. Gustlock geometry for Convair-Liner type aircraft.

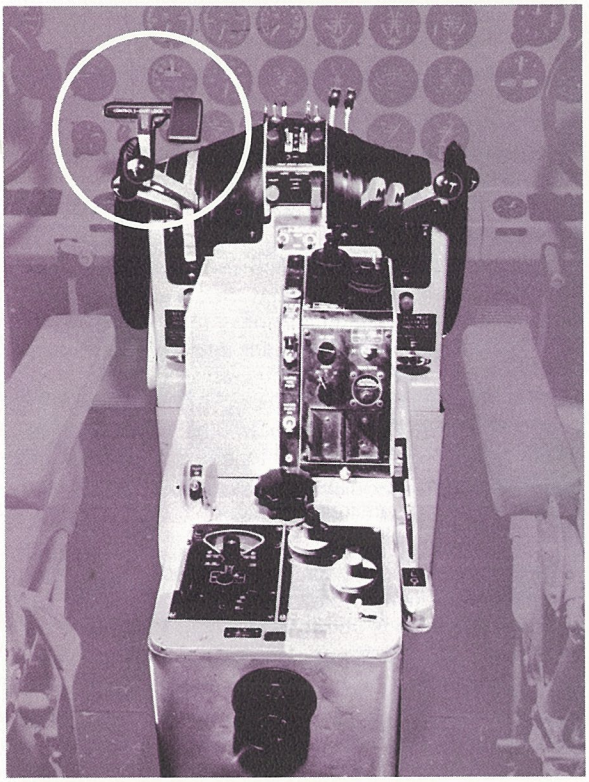


Figure 2. Place gust lock lever in forward, or unlocked, position, before joining various cable assemblies, shown in figure 3.

SURFACE GUST LOCK MOVEMENTS

Aileron—Determination of control lever travel to begin locking ailerons:

Required movement of lockpin to begin locking ailerons is 0.50 inch.

Cable travel required for 0.50 inch pin movement is 1.435 inch. Cable stretch is negligible.

Control lever travel required to begin locking ailerons is 7.7°, or 1.95 inches.

Elevators—Determination of control lever travel to begin locking elevators:

Required movement of lockpin to begin locking elevators is 0.79 inch.

Cable travel required for 0.79 inch pin movement is 2.27 inch. Cable stretch is negligible.

Control lever travel required to begin locking elevators is 12.2°, or 3.08 inches.

Rudder—Determination of control lever travel to begin locking rudder:

Required movement of lockpin to begin locking rudder is 1.09 inches.

Cable travel required for 1.09 inch pin movement is 3.13 inches. Cable stretch is negligible.

Control lever travel required to begin locking rudder is 16.8°, or 4.25 inches.

See figure 1 for spring loads, locking handle loads, plunger travel, and spring rate.

GUST LOCK RIGGING PROCEDURE

The following illustrations give a pictorial step-by-step procedure for rigging gust locks on Convair-Liner type aircraft.

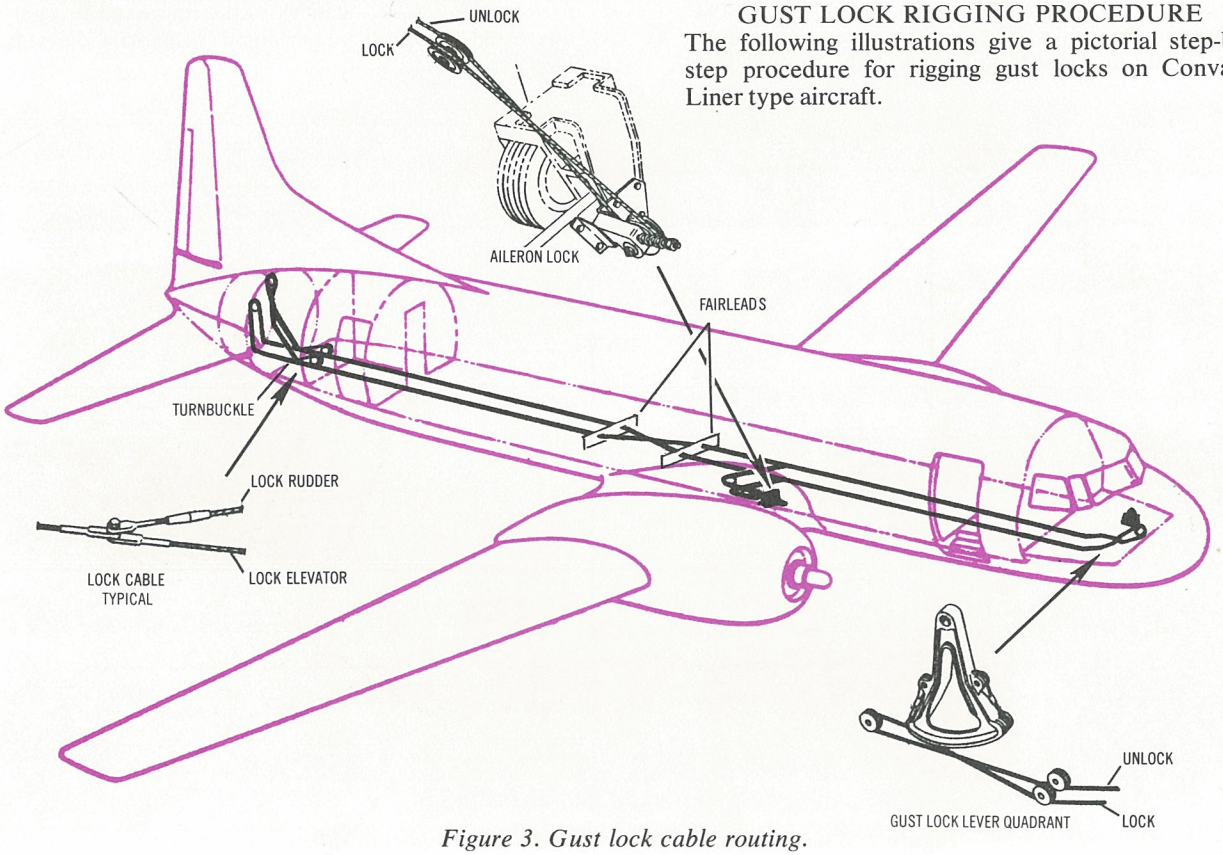


Figure 3. Gust lock cable routing.

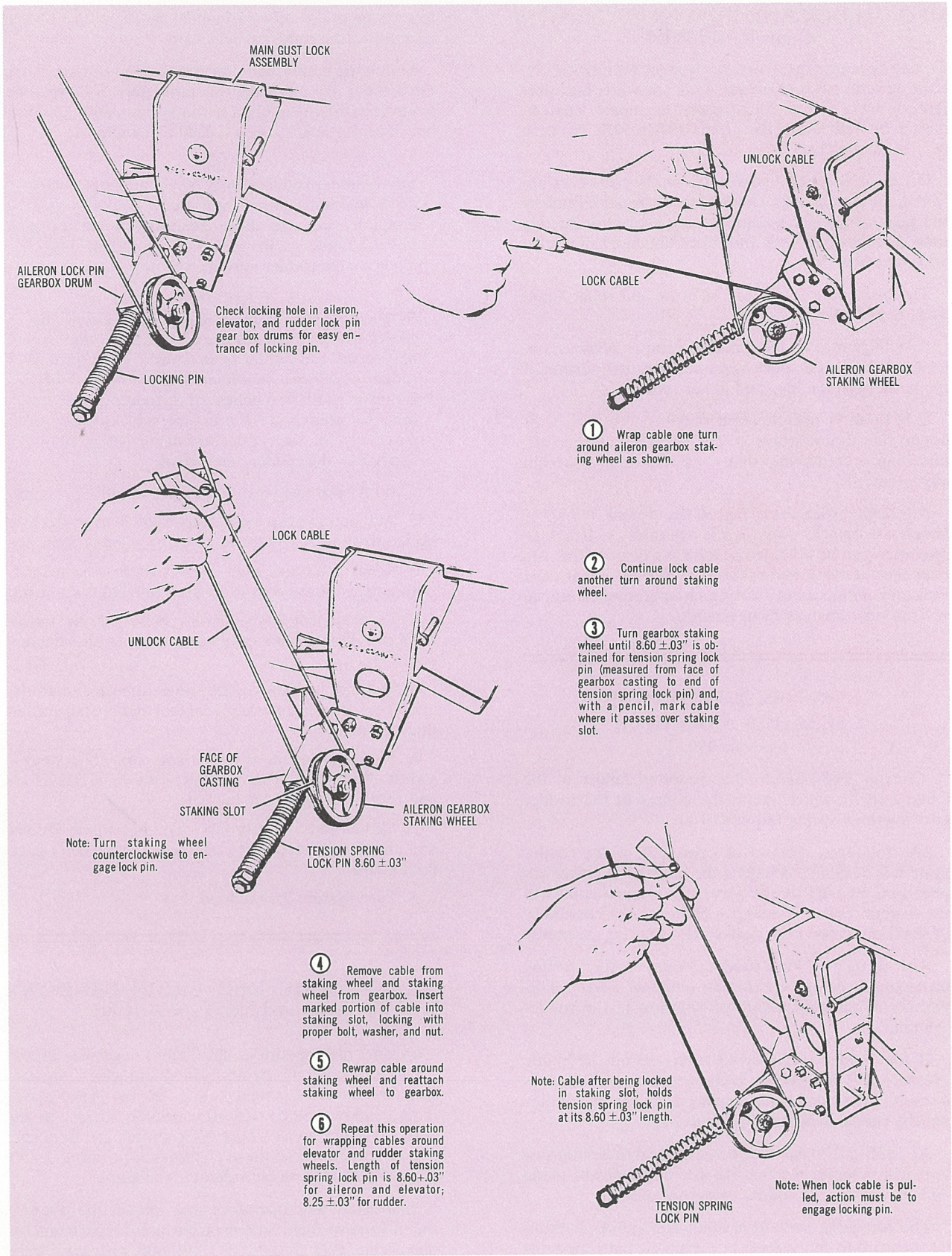


Figure 4. Gust lock rigging procedure.

MLG UPLOCK AND ROLLER LUG LIMITS
Convair 880/880M

During recent inspections on Convair 880/880M aircraft, several cases of uplock hook and roller lug interference were found. Satisfactory alignment was obtained by relocating the shims (9729-120) on each side of the uplock.

Once correct relationship between the parts is established, further checks should not be required unless the gear or uplock assemblies are replaced. At this time, a recheck of hook and roller alignment should be accomplished.

The procedure for obtaining hook and roller alignment is as follows:

1. With gear retracted, check clearance between uplock roller lugs on shock absorber and that portion of the hook between lugs and lower roller.

2. If hook is not centered between the lugs, shift upper side brace fitting (9729-77) either fore or aft, installing or removing shims, as required, to obtain alignment.

Although exact centering of the uplock hook between the uplock roller lugs is desirable, satisfactory operation can be obtained as long as a clearance exists between the hook and roller lugs. Service experience indicates minimum of 0.040 inch operating clearance will provide satisfactory operation.

POWER RUDDER SYSTEM OPERATION AND CHECK
Convair 990

A Convair 990 operator has reported failure of the Cherry rivets which retain the collars in the rudder gust overload spring (30-48410-1).

The following method of operation of the rudder system is designed to reduce the number of power applications as well as the force of the applications to the system. This is intended to eliminate the possibility of shearing rivets in the gust overload spring assembly.

Always turn on both rudder systems before turning on auxiliary pump or external hydraulic power. This permits a gradual buildup of pressure in the rudder system.

If the rudder is displaced from neutral, hydraulic pressure will be directed to the actuating cylinders as a result of the valve being displaced. As pressure builds up, the rudder will move to neutral.

At 1800 $\pm$ 100 psi, the power manual reversion system will actuate, placing the system in power mode and completing the rudder centering action.

The foregoing method of operation applies hydraulic pressure to the system in a manner that eliminates the shock of sudden application of full system pressure. The fact that hydraulic pressure may move the rudder toward neutral, while in manual mode, is in no way harmful to the rudder mechanism.

Following is the recommended method of checking the system. By following this procedure, full pressure is never suddenly applied to the system, and the number of power applications is held to a minimum.

Note

Move rudder pedals slowly when utilizing the auxiliary hydraulic pump for system checks so as to preclude pressure drops resulting in power to manual mode oscillations with attendant impact loads on the rudder system.

CAUTION

Before turning on hydraulic power, check that power rudder switches are on. Surface wind may have displaced rudder from neutral, even through rudder pedals are held in neutral by the gust lock; if power rudder switches are turned on after hydraulic system is at full pressure, subsequent rapid movement of the rudder will occur with possible damage to the rudder mechanism.

1. With both systems on, apply hydraulic pressure.

2. Actuate EXCESS PWR TEST switch to system 1, noting that EXCESS PWR and 2 SYST OFF lights come on.

3. Actuate EXCESS PWR TEST switch to system 2, noting that EXCESS POWR to 1 SYST OFF lights come on.

4. Turn system 1 switch off. Note that system 1 SYST OFF light comes on and LOW PWR light remains out.

5. Move rudder slowly full travel in both directions, and check consistency of pedal feel and pressure gage fluctuation.

6. Turn on system 1 switch and turn off system 2 switch. Note that system 2 SYST OFF light comes on and LOW PWR light remains out.

7. Move rudder slowly full travel in both directions and check consistency of pedal feel and pressure gage fluctuation.

8. Turn system 2 switch on.

PLASTIC-SHIELDED CABIN WINDOWS
Convair-Liner Type Aircraft

Convair-Liner operators may improve service life of their cabin windows by replacing them with a window that has a plastic shield bonded to the outer glass. This window was developed especially for use in the forward cabin areas where rock strikes are frequent. Many operators use these windows at positions 1 and 2, RH and LH, with considerable success.

Interested 640 operators may obtain the overlay cabin window from Support Contracts Department by specifying P/N 340-3310312-9; 600 operators may obtain the overlay cabin window by specifying P/N 240-3310311-17.

ANTI-SKID MODULATOR RECHARGING
Convair 600/640

When servicing the anti-skid modulator on Convair 600/640 aircraft, it is important to evacuate all hydraulic fluid from the fluid side of the modulator in order to obtain a full air precharge.

This can be done by operating the brakes while applying the charge. The restrictor on the modulator is small; thus, several charges followed by brake action may be required before full modulator charge can be obtained.

INBOARD PYLON AFT STRUT BOLT REMOVAL FACILITATED
Convair 880/880M

One Convair 880 operator reported that the lower bolt on the aft strut of the inboard pylon is difficult to remove and there is no provision for use of a puller.

To facilitate future removal, it will be permissible to enlarge the hole in the head of the 22-24078-9 bolt and tap it for a 5/16-24 UNF thread for attachment of a screw or impact type puller. Depth of the hole should be limited to 0.900 inch, measured from the top of the head (0.100 above the bearing face).

A threaded reducing bushing may be fabricated and installed in the tapped hole to accommodate the original screw used to attach the coverplates (22-24078-7,-8) or, the hole and countersink in the cover may be enlarged to accommodate the 5/16 screw.

To preclude galvanic corrosion of the aluminum cover, caused by the dissimilar metals, the corrosion-resistant steel screw and bronze washer may be replaced with cadmium-plated steel parts.

NLG DOOR LINK ASSEMBLY
Convair-Liner Aircraft

Service Engineering Report No. 6820/65-340-59/440-59 approved the 240-3150412-803 bungee type nose landing gear door actuating rods for use on 340/440 aircraft. These rods are also approved for use on all Convair-Liners which have been modified by installation of Dart engines. They are not approved for use on aircraft equipped with Allison engines, because of their higher Vno speed (321 mph).

As a result of recent requests, Convair has approved the bungee type rods for Convair-Liners with a Vno speed of 321 mph, if the springs are preloaded to 850 pounds. Convair has now designed and plans to stock P/N 240-3150412-501 link assemblies with this preload.

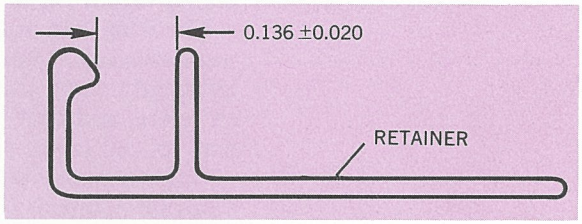
Operators interested in these new bungee type link assemblies may obtain price and availability from Convair Support Contracts Department.

ENTRANCE AND SERVICE DOOR SEALS
ANTI-STICK AGENT

Airlines operating in cold climates have experienced difficulty with sticking of the service and entrance door seals. The seal tends to freeze to the door frame and, when the door is opened, the seal pulls loose from the retainer.

Some operators have used talcum, soapstone, and DC-4 to alleviate the problem. While DC-4 will not adversely affect the neoprene (black) seals, it causes the silicone (gray) seals to soften and appear loose. Actually, the silicone rubber seals should not freeze to the airframe if the seal and striker are clean.

Too, pulling loose of the seals may possibly be caused by a deformed retainer. Operators may fabricate a go-no-go gage to check width of the retainer. Correct width is shown in the sketch.



Convair has tested a spray-on fluorocarbon material that releases ice easily. The material tested was Rulon Spray No. 2, a product of the Connecticut Hard Rubber Company. Its effectiveness is dependent upon proper surface preparation. Convair, after several test methods, has found the best method of application to be as follows:

Wash the area around the door opening with MEK to remove all oil. Pay particular attention to seal striker and area outboard of the striker, since this is the area where ice is most likely to form.

Sand the parts with No. 600 grit paper to provide a bright surface.

Wipe parts again with MEK until no more darkening is noted on the cloth.

Apply a light, uniform film of Rulon No. 2, by spraying 6 to 8 inches from the seal.

The sprayed area dries to a dull, non-sticky surface within 5 to 10 minutes.

Rulon Spray may be removed by brushing or soaking the area in Acetone.

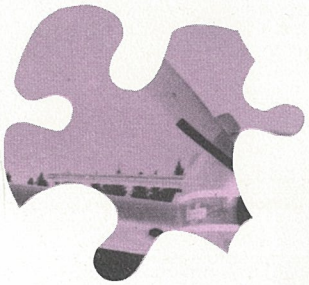
Rulon Spray No. 2 may be obtained from the following outlets:

Griswold Engineering, Ltd
1150 Marine Drive
North Vancouver, B. C.

A. E. Boyd Company
763 East 14th Street
Los Angeles, Calif.

American Packing & Gasket
6039 Armour Drive
Houston, Texas

W . S. Nott Co.
201 North Third St.
Minneapolis, Minn.



ONE + ONE = ONE

ONE OF THE MOST INTERESTING repair tasks ever undertaken on a Convair airplane was instigated by John Doig, Manager of Convair Support Contracts, during one of his customer visits to Finnair in Helsinki, Finland.

The unique repair, or rebuilding job came about last fall when Doig assessed damage of a 440 purchased by Finnair from Kar-Air, another Finnish airline. The damaged airplane was being used for parts replacement and repairs for their eight other Metropolitan 440's.

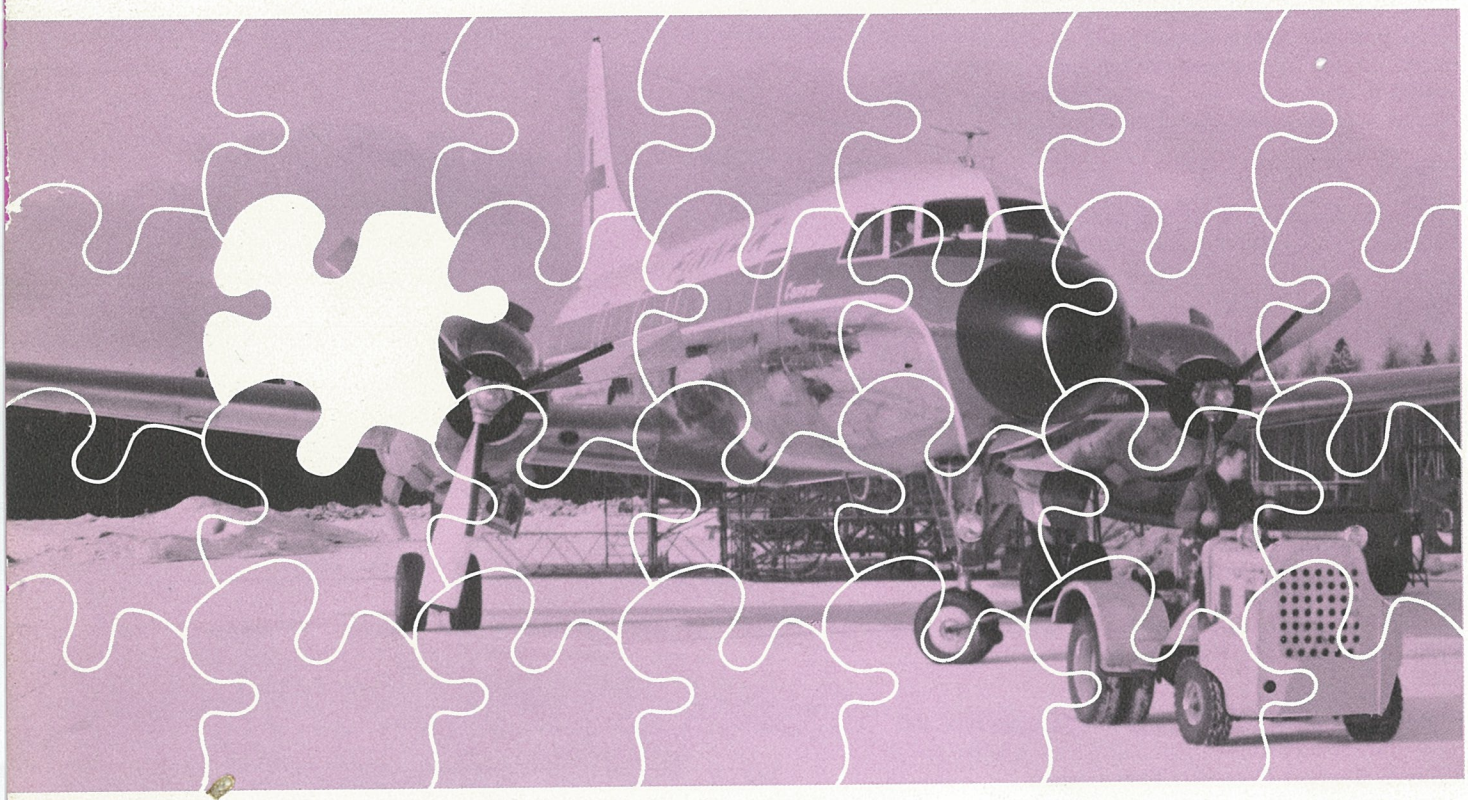
Doig recalled the burned wing from a Jugoslovenski Aerotransport (JAT) 440 stored at Belgrade since 1961. He recommended that Finnair buy the wing and restore the Metropolitan instead of using the parts for replacement.

"An analysis of man-hours and parts to put the airplane into flying shape with the JAT wing would cost considerably less than the price of another airplane," Doig explained.

The wing was trucked to Helsinki through Russia last fall, and ground crews went to work. They used the entire right section of the wing and rebuilt the left-hand center section using JAT and Kar-Air bulkheads and fittings; skin, stringers, and spar rails were new. The outboard section of the Kar-Air wing was spliced to the rebuilt center section.

The necessary parts for repair of the wing and fuselage were ordered from Convair. Convair also loaned nacelle-locating tools, and provided technical and engineering advice.

The "good-as-new" Metropolitan went into passenger service April 3 and, according to the pilots, it is the best in the Finnair fleet.



GENERAL DYNAMICS
Convair Division

VOLUME XIX NUMBER 2 JULY/AUGUST 1967

Convair Traveler

11 44

In This Issue: *Clamps*
Care and Handling of Hose Assemblies
Engineering Clinic

VOLUME XIX NUMBER 2 JULY/AUGUST 1967

Convair Traveler

In This Issue: Clamps
Care and Handling of Hose Assemblies
Engineering Clinic

OUR COVER

Tony Adams, artist, may not know it, but his character on the cover will never make expert unless he exercises a little more care in the handling of clamps and hose assemblies. We show him the proper way in this issue.

Convair Traveler

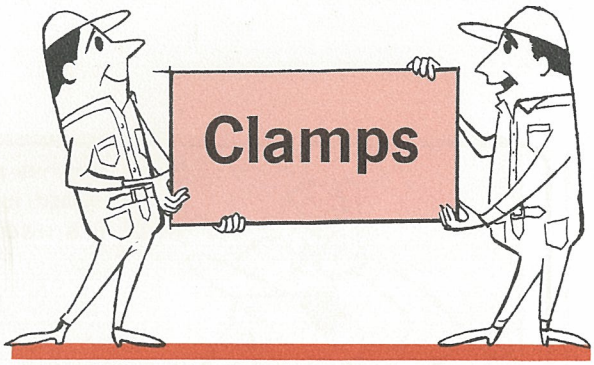
VOLUME XIX NUMBER 2 JULY/AUGUST 1967

DIRECTOR OF AIRCRAFT SALES & SERVICE
PHIL PROPHETT
MANAGER, CUSTOMER SERVICE—**O. W. HARPER**
CHIEF, FIELD SERVICE—**R. E. SOMMERS**
MANAGER, SERVICE PARTS—**J. DOIG**
MANAGER, TECHNICAL PUBLICATIONS
H. R. KENNEDY
EDITOR—**GERTRUDE S. HUNTER**
ART EDITOR—**A. R. THOMPSON**

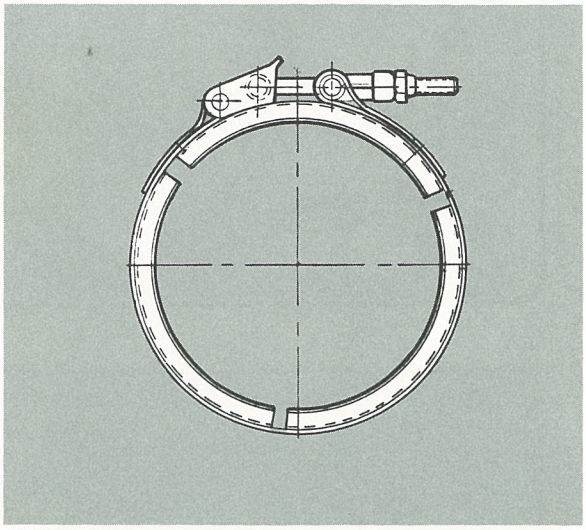
IN THIS ISSUE

A digest of operation and service published bimonthly by the Technical Publications Section of the Convair Division of General Dynamics, primarily for the interest of Convair operators.

CONVAIR DIVISION OF GENERAL DYNAMICS



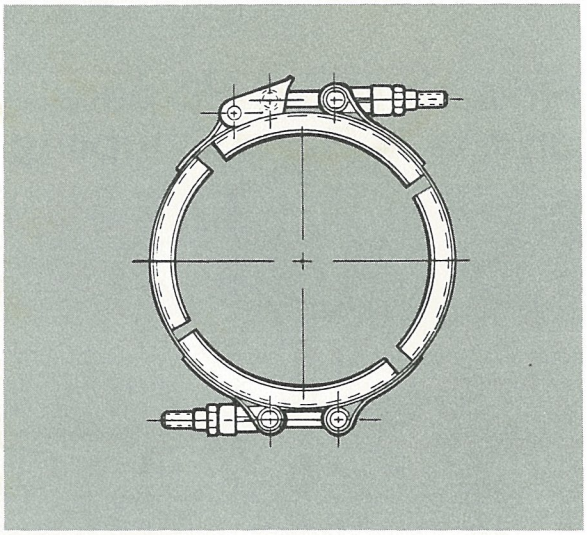
CLAMPS ARE USED throughout aircraft for attaching and supporting tubing, hoses, wiring, harnesses, and other types of equipment. The clamps may be simple one-piece design or may consist of a band, T-bolt, nut, and trunnion in which the band is slotted at the loop end to provide for even circumferential takeup.



They can be small enough to attach a jumper or to hold a cable smaller than 1/16 inch snugly in position, or to simplify installation of large engine ducting or piping.

Some clamps are cushioned to support such equipment as fuel sensing units. Cushioning may be chloroprene type synthetic rubber, recommended for usage where aging, weathering, and oil resistance is required; of Teflon where exceptional thermal stability, aging, weathering, and electrical properties are required; of asbestos for extremes in temperature, and for chemical resistance.

Some clamps have a quick disconnect latch that permits quick, easy, and frequent installation or removal. Some clamps have a double latch—a latch on opposite sides of the clamp. This combination provides for more diametrical takeup and permits equal circumferential distribution of larger diameter clamps.

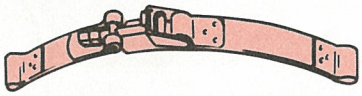


Then, there are the thumb screw hose fastener hand clamps which provide a vibration-proof installation. These clamps are used for general purpose applications where strength is not a consideration.

All clamps are not round. There are square clamps, oblong clamps, irregularly shaped, and elliptical flanged clamps. Clamps like the one illustrated at the top are used for supporting instruments and light accessories. The oblong clamp at the bottom is for supporting wire harnesses.

One of the uses for the squared-off T-bolt clamp illustrated on the right is for supporting the main wheel brake adjusters on the Convair jet airliners.

Straps are used for tie-downs and for many equipment-holding applications.

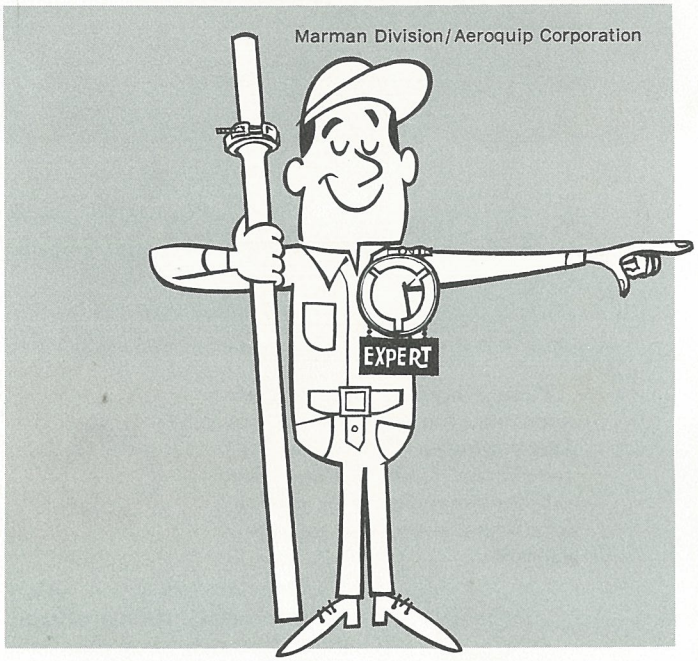


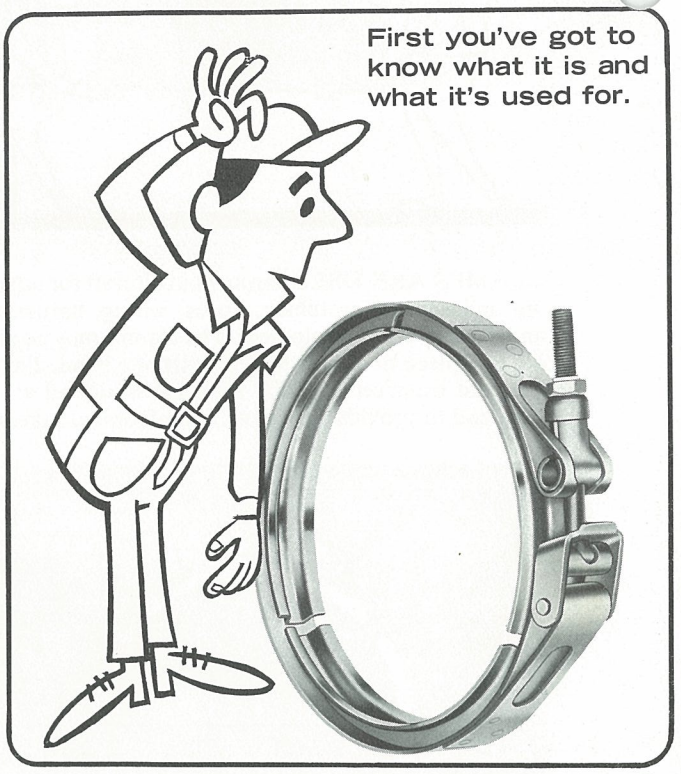
This discussion will be concerned only with the V-band coupling. This type clamp, or coupling, requires a certain amount of skill to properly align a duct or tube, seat the gasket, and torque the clamp. An improperly installed clamp could cause fuel or hydraulic fluid leakage, presenting a hazard.

The Marman Division of Aeroquip Corporation has given us permission to reproduce material from their pamphlet on the correct handling and installation of the V-band coupling. This coupling can be removed and replaced by one man in a few seconds. Although it is a simple operation, incorrect handling and installation of the coupling could jeopardize system integrity.

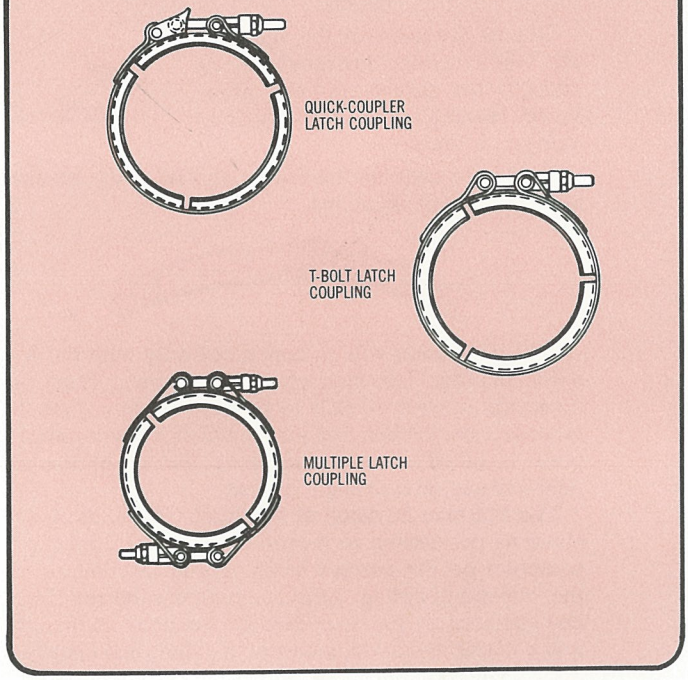
By observing the following simple rules, you can qualify for expert on the Marman V-band coupling.

How to Make "Expert" on the V-Band Coupling



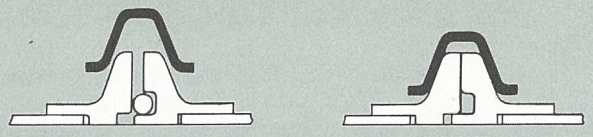


And it comes in three basic models...

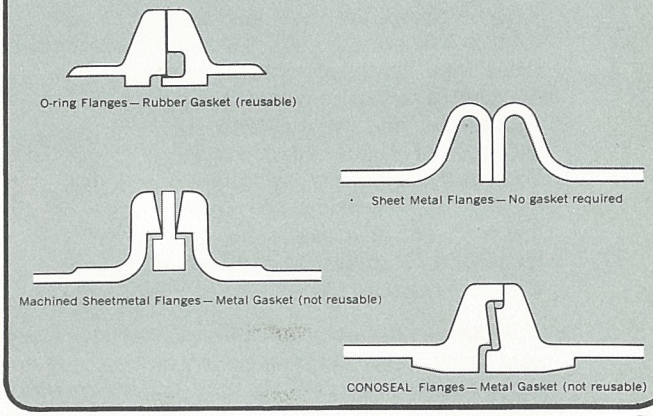


So what does it do?

It really just squeezes the flanges together.
The engineers call it "efficient wedging action."

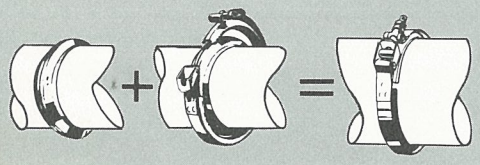


V-BAND COUPLINGS ARE USED ON DIFFERENT TYPES OF FLANGES. HERE ARE SOME OF THEM:



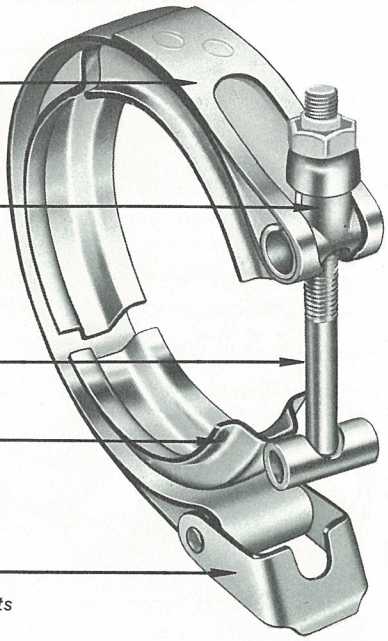
A one-man operation... On or off in a few seconds

A V-band coupling is used to connect and seal tubing and ducting. Or to attach accessories. All you have to do is insert the gasket (if any) on the flanges and slide on a quick-and-easy Marman V-Band Coupling.



FLANGED DUCTING MATING V-BAND COMPLETE JOINT

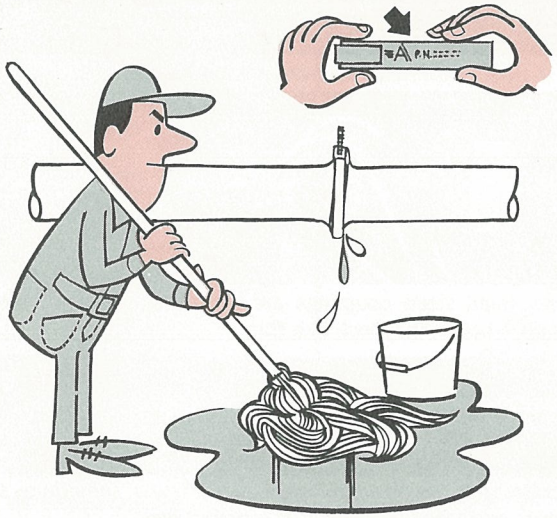
COMPONENT PARTS



(Note: other designs have T-bolts contained within the Strap)

And now you're ready to put the V-Band coupling to work (almost)

But first you'd better check the part number. Make sure it's the number called-out in your parts manual. Couplings may look alike, may even fit O.K. But each type has its special use. Expect a lightweight to do a heavyweight's job and you may have to mop up the leaks.



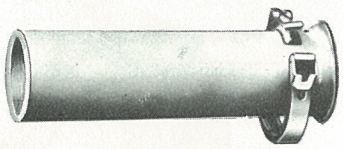
And there can be no misalignment or offset of the two tubes to be joined.

WRONG RIGHT

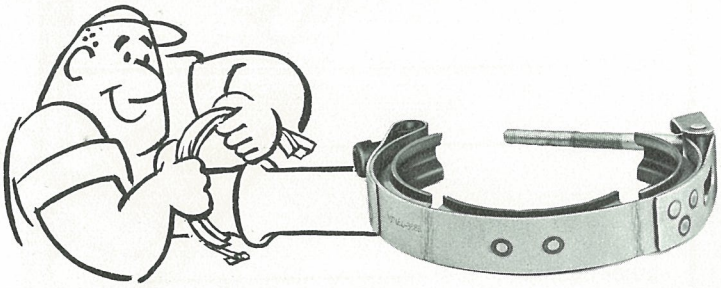
V-band couplings are not designed to be used as rigging tools to correct misalignment—nor to support equipment during assembly.

Now You're Ready!

A.

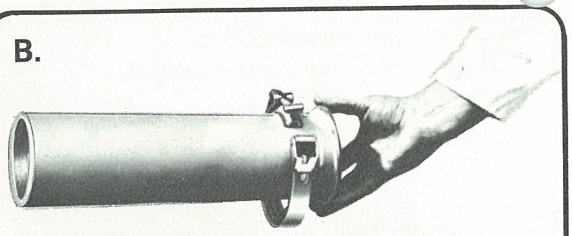


Slip the coupling over the flanged tube or ducting. Don't spread it more than necessary. Save your muscles. Convair recommends a light coat of wax on the slanting surface of the duct flange and inside the "V" retainer.



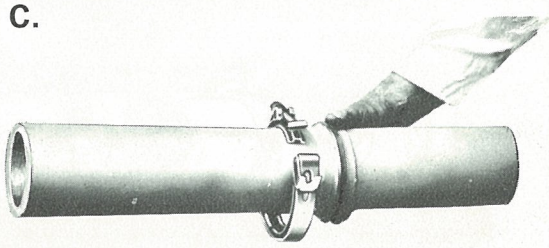
This is what happens when the coupling is over-spread. The band gets kinked and the spotwelds are weakened. Don't use a coupling in this condition.

B.



Put gasket (if any) in place carefully. Make sure it is properly seated.

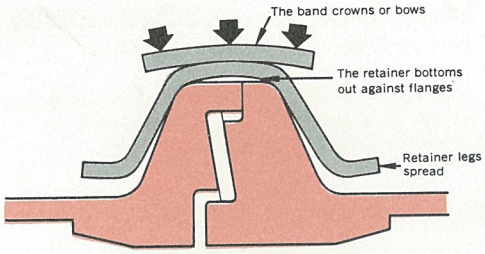
C.



Bring mating flange into position. If there's any index, be sure it's engaged. Flanges must meet exactly and easily. Don't use the coupling as a "pipe stretcher"!

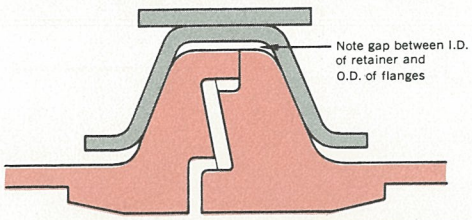
More on the evils of overtorquing...

This is what happens when a coupling is overtorqued.

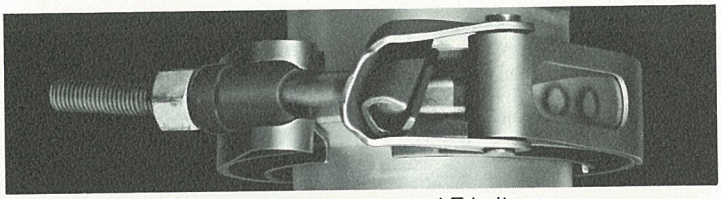


CROSS SECTION OF V-BAND COUPLING OVER FLANGES

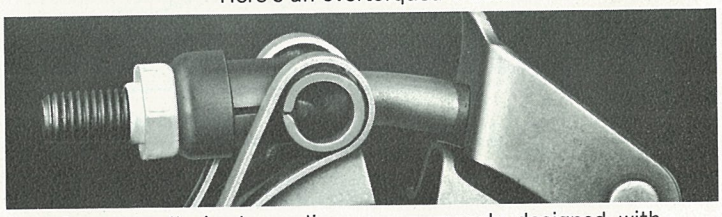
Here is what it looks like when properly torqued.



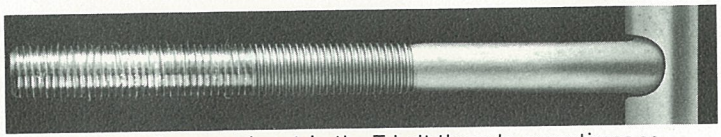
Overtorquing can ruin the T-bolt too!



Here's an overtorqued T-bolt

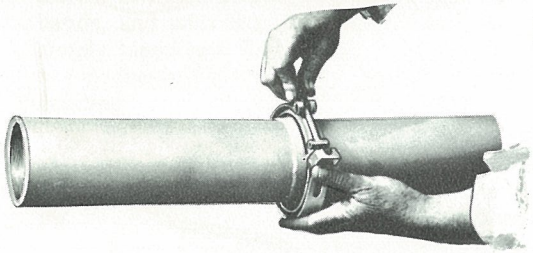


Some small sized couplings are purposely designed with curved T-bolts. They look like this.



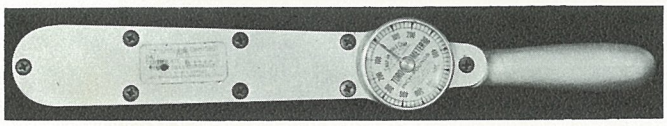
Overtorquing can also strip the T-bolt threads, sometimes so slightly as to be invisible to the naked eye.

D.



After the flanges are together, bring coupling into position over them. Press the coupling around the flanges, and engage the latch. Latch must be seated tightly so that there is no clearance between bolt and latch.

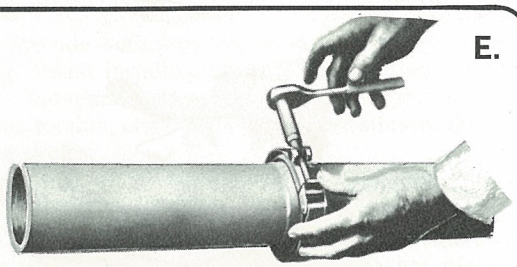
Nothing to it so far, right? But, now you've come to the most critical part of the operation.



For initial tightening, a small socket wrench may be used. But, for final tightening to required torque value, switch to a torque wrench.

Remember, just using a torque wrench doesn't guarantee success. You've got to use it correctly. The main thing is COUPLINGS MUST NOT BE OVERTORQUED!

E.



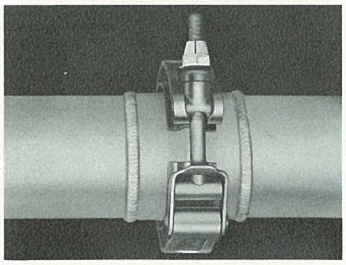
But first you'd better check the part number. Make sure it's the number called out in your parts manual. Couplings may look alike, may even fit O.K., but each type has its special use. Expect a lightweight to do a heavyweight's job and you may have to mop up the leaks.

F.

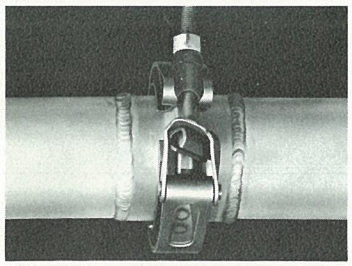
Tighten until specified torque is reached.

STOP! Don't overtorque!

See the difference?



CORRECT



INCORRECT

Note bent T-bolt, turned T-bolt head, deformed quick-coupler.

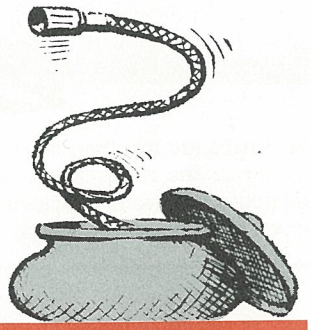
Seven Ways to Avoid Goofs!

1. Make sure you've got the right part number.
2. Check in your parts manual for correct torque for each specific coupling.
3. Do final tightening of couplings with torque wrench only.
4. If you've got a leaky joint, extra tightening won't help. You've got the wrong coupling, a damaged flange, or a non-reusable gasket.
5. Be sure T-bolt is correctly seated.
6. Don't use V-band couplings as rigging tools or pipe stretchers.
7. Never deliberately bend a T-bolt to force a coupling to fit.

You Made It!

Good, you qualify for expert on the Marman V-band coupling. You should be getting your medal any day now.

Care and Handling of Hose Assemblies



HIGH-PRESSURE TEFLON HYDRAULIC HOSES, installed in Convair jet airliners, consist of an extruded teflon compound, reinforced with two layers of synthetically-bonded spiral-wrapped stainless steel, over a single spiral-wrapped layer of teflon-impregnated glass fiber. An outer cover of braided stainless steel wire is synthetically bonded to the reinforcement. Hoses in the engine section are further encased in a wrap-around asbestos or woven fire shield.

The selection of teflon as the lining material for these hoses was made because of teflon's particular characteristics. It is tough, flexible, easily cleaned, unaffected by virtually any foreign substance with which it might come in contact in an aircraft installation. It is a plastic which has good resistance to heat; it has unlimited shelf life.

Although these hoses perform well for their specified applications, they are not super hoses. In fact, certain pecularities demand understanding and attention. It is particularly important, therefore, that personnel handling these hose assemblies be acquainted with proper handling characteristics.

The synthetic rubber material used to bond the braided stainless steel outer cover contains a neoprene base. During the braiding operation, a small amount of the bonding material "strikes through" the braid, and under some conditions (such as contact with non-petroleum base fluids) may become slightly tacky. This is not detrimental, nor does it affect the condition or service life of the hoses. The bonding material serves only to assist in the bonding operation, and is nonfunctional after the braiding is completed.

Teflon, as compared with most other lining materials in tube assemblies, has a limited capacity for taking sharp bends. Manufacturers of teflon-lined hose assemblies are careful to specify minimum bend radii. There are, however, some installations where the bend radii have been exceeded. These hoses may have been initially fabricated by the vendor under controlled conditions and are, therefore, acceptable. Most installations, however, have been designed to avoid sharp bends, or the line bends are accomplished with elbows and certain other tube end fittings.

Teflon, when subjected to sufficiently high heat in service, may take a degree of "set." It is then somewhat less capable of withstanding excessive bending. Such a tube or hose can remain in service, but it can no longer stand the same amount of bending without damage. For these reasons, it is advisable to treat teflon-lined hose assemblies as though they were never meant to be bent.

Following are some practical points on how teflon-lined hoses may be handled to best advantage in maintenance operations.

Teflon hose lines in hot fluid systems will tend to preform themselves to the installed position. Some lines are preformed by the manufacturer. For this reason, care should be exercised in handling and removing these hoses from an installation. Bending or excessive handling will tend to crimp them.

Whenever a hose is to be removed or reinstalled, hold the tube shank hex with a wrench; then, use a second wrench to loosen or tighten the attaching nut. This prevents the teflon liner from being twisted. The possibility of damaging the teflon line is greater with the shorter hose lengths; there is less length to absorb the twisting action.

In the case of a leak in the fuel manifold, turn one hex flat. If the leak persists, tighten one more flat —no more. If it still drips, change the manifold. Never turn the end fitting on the teflon hose. It is preset and fixed to the hose. Turn it and the hose will turn with it. Tighten only on the fuel nozzle tee side. The hex fitting on the metal line is welded. It will not turn. This is explained in figure 1.

Tube assemblies, removed or to be stored, are to be left in the shape in which they were formed, with no attempt being made to straighten them, or to fold

them. One expedient is to use a piece of safety wire to prevent the radius curve in the hose from straightening. The wire is attached from fitting to fitting, as shown in figure 2. For assemblies with one or more bends, and with long assemblies, the hoses may be simply taped to a light board to assure that they are not inadvertently subjected to straightening or reverse bending.

Before installation, tube assemblies are to be placed outside the work area to avoid possibility of crushing. Careful handling will not only prevent bending, but will preclude damaging the end fittings.

Tube assemblies with elbow and straight-through end fittings are installed by attaching the elbow first. Similarly, with swivel and straight-through ends, the swivel end is attached first, but not torqued. It is secured until connection has been made and correct alignment established. Thus, it is not necessary to twist the tube to obtain alignment with the elbow or swivel.

Provide sufficient free hose to allow for some flexing. When installing clamps, be sure they do not restrict movement. Clamps should not subject hose to tension, torsion, compression, or sheer stresses during flexing cycles.

Too much flexing may cause kinking. Bend the hose in the same plane as the movement to avoid twisting. Flexing hose that is bent in two planes requires a clamp at the point where the hose changes planes. This has the effect of dividing the hose into two sections. Figure 3 shows the right and wrong ways of installing teflon hose.

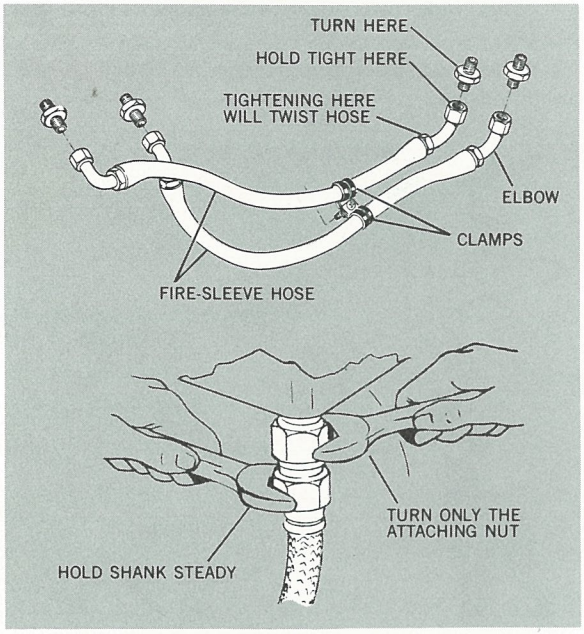


Figure 1. Engine fuel supply line fire-sleeve hose connection.

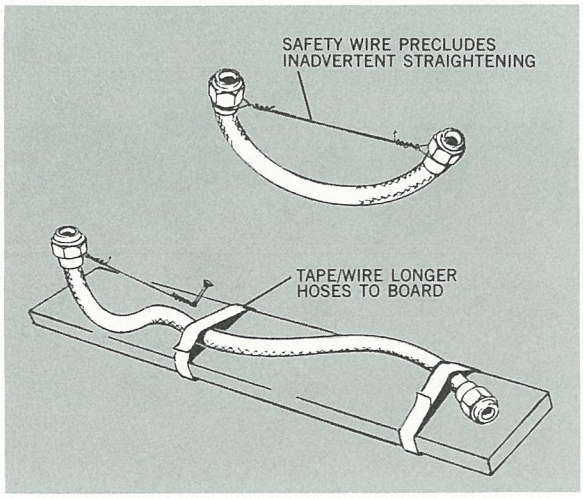


Figure 2. Flexible hose handling precautions.

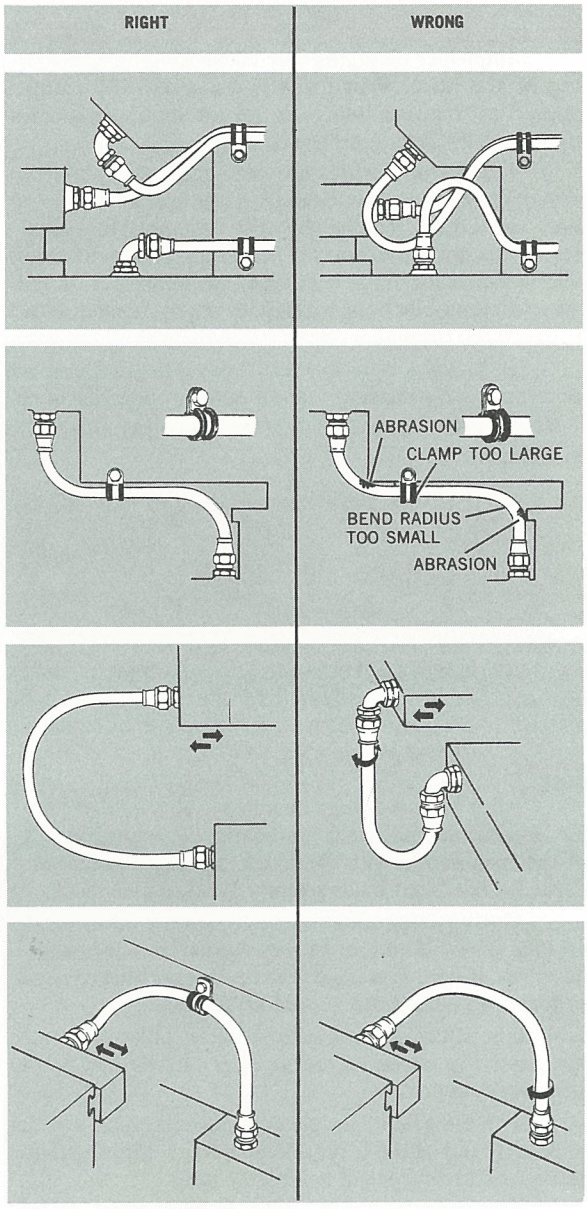


Figure 3. Right and wrong ways of handling hose.

Incorrect clamping may lead to excessive vibration of the tubing and result in leakage of fluid at the MS fittings. To preclude this possibility, hydraulic tube clamping dimensions, as prescribed in Specification MIL-H-5440C, paragraph 3. 10. 28. 9, are given for the convenience of interested operators. Clamps should be installed on straight sections of tubing and as near as practicable to bends in the tubing. This will minimize vibration in critical areas.

Nominal Tube OD (inches)	Max Length (inches) between Support Centers	
	Aluminum Alloy	Steel
1/8	9 1/2	11 1/2
3/16	12	14
1/4	13 1/2	16
5/16	15	18
3/8	16 1/2	20
1/2	19	23
5/8	22	25 1/2
3/4	24	27 1/2
1	26 1/2	30
1 1/4	28 1/2	31 1/2
1 1/2	29 1/2	32 1/2

Improper clamping can cause kinking and chafing of the hose. When this is observed, the clamps should be repositioned. Do not attempt to maintain clearance by prying on the line.

Crimps or buckles are not acceptable. A crimp or buckle is an abrupt change in contour of the teflon line, caused by bending the hose assembly to a smaller radius than the normal flexibility of the line will allow. Once the hose is dented, the imperfection will stay. It cannot be bent back to its original shape. Fluid is restricted through a crimped or bent line.

If kinking is suspected, hose integrity can be determined by passing a steel ball through the hose.

The vendor has established the following hose/ball-size limits.

HOSE SIZE	BALL SIZE
–4	5/64
–5	9/64
–6	13/64
–8	9/32
–10	3/8
–12	1/2
–16	47/64
–20	61/64

A crimp in a teflon line will not be apparent, since the metal band is unaffected by the bend. Too, it is difficult to determine accurately the degree of damage.

A feel test is required to determine a crimped hose.

After hose has been installed, pull shield back as far as possible and check installation. Press the length of the heat shield with the hand to feel if the line underneath has been inadvertently twisted or kinked.

During inspection, check hoses for abrasion or broken wires. Random broken wires are acceptable; however, if wire breakage is excessive – either general or localized – the hose should be replaced.

Check that hose is not chafing on adjacent structure, moving parts, or other lines. Lines are to be securely clamped.

The ends of a disconnected hose should not be tucked up out of the way to keep it from dripping. Too sharp a bend may possibly kink the hose.

Hoses are not to be used as hand holds or for supporting objects.

Do not leave hose connected to removed engine accessories because further movement of the accessories can damage the hoses.

Convair has not established firm recommendations in regard to service life of teflon hoses because there are so many variables that enter into the length of time a hose may be safely utilized in an installation. Among the variables that affect service life are the number of cycles per flight hour on the hoses, operating temperatures, particular application of the hoses, and types of construction.

Many operators have developed hose inspection and replacement schedules based on their own experience and operating conditions. By conducting periodic inspections of the individual hose applications, these operators have been able to establish a time interval replacement which eliminates most in-service failures and, at the same time, provides satisfactory hose service life.

Following are a few reminders when handling hose assemblies.

ENGINEERING CLINIC

AILERON-RUDDER INTERCONNECT SPRING
Convair 600/240

There are three aileron-rudder interconnect springs recommended for use on Convair 600 and 240 aircraft. The original 240 interconnect springs were P/N 240-8440103-Basic. These springs were installed on the first 90 production aircraft and are not now recommended for use. The basic springs were replaced by springs P/N 240-8440103-6. This change was made to increase aileron movement when the rudder is actuated, in order to improve stability of the airplane. Figure 1 shows details and usage of these springs.

Certain Convair 240 aircraft (versions 23, 24, and 25) were equipped with outer panel fuel tanks. On these airplanes, stiffer springs were required in order to maintain the lateral stability characteristics of the aircraft. This spring (P/N 240-7230065-6) is shown in figure 2.

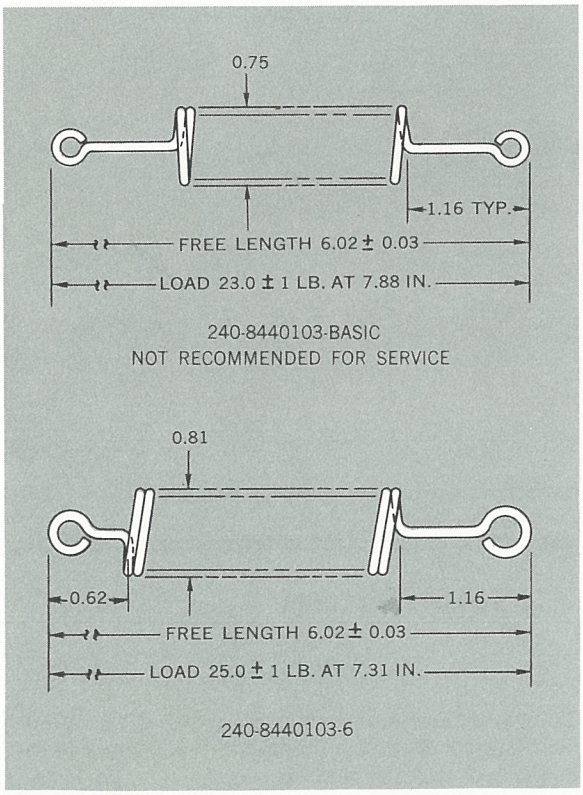


Figure 1. Aileron-rudder interconnect spring (P/N 240-8440103-6) for use on Convair 240 and 600 without outer panel tanks.

Convair 240 aircraft with outer panel fuel tanks, which have been modified to the Convair 600 configuration, require aileron-rudder interconnect springs P/N 2D-0040402-7. Details of this spring are shown in figure 3.

Convair 600 aircraft without outer panel fuel tanks require two 240-8440103-6 springs; Convair 600 aircraft with outer panel tanks require two 2D-0040402-7 springs. Rigging procedure is the same for both spring installations and is given in the 240 Maintenance Manual.

Because of the differences in the springs, they are not interchangeable and should not be mixed in installations.

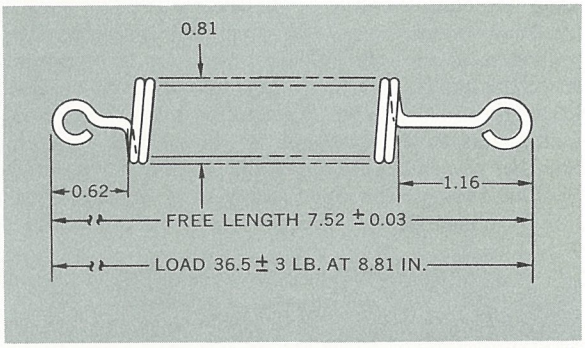


Figure 2. Aileron-rudder interconnect spring (P/N 240-7230065-6) for use on Convair 240 with outer panel tanks.

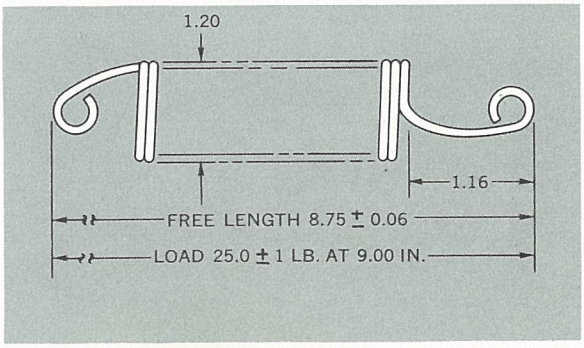


Figure 3. Aileron-rudder interconnect spring (2D-0040402-7) for use on Convair 600 with outer panel tanks.

CONTROL CABLES–FATIGUE WEAR

Control cables become worn after a certain period of service, and should be replaced before breakage occurs.

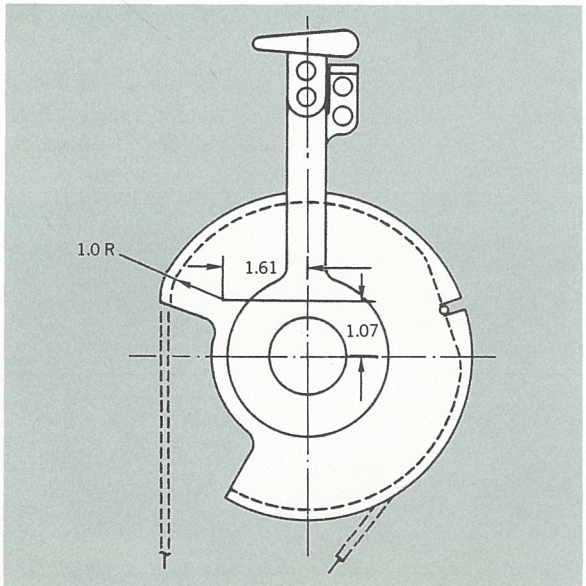
Tests indicate that cables may have broken wires without showing any critical loss of strength. A 7 × 7 cable, for example, may have as many as three broken wires in any one foot of length and still carry its rated load; a 7 × 19 cable may have as many as six broken wires per foot and still carry its rated load.

Cables can be checked for broken wires by rubbing a cloth over the surface. Broken wires will snag the cloth.

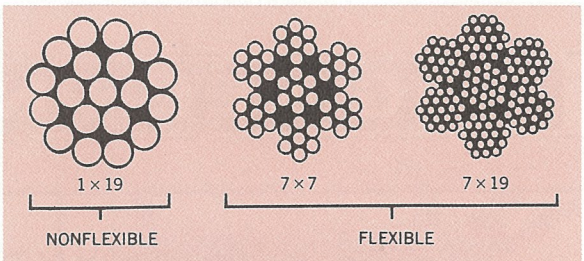
Wire breakage occurs most frequently where cables pass through fairleads and around pulleys; therefore, these areas should be checked carefully, and broken wires clipped short to prevent interference and injury to personnel. Badly corroded or worn cables should be replaced.

While the appearance of one to three "whiskers" on a cable through the pulley or fairlead area may denote some wear, it does not necessarily indicate that the cable is unserviceable, provided it is worn extremely flat (two or more wires or two or more strands worn flat more than 50%) and there is no evidence of core corrosion.

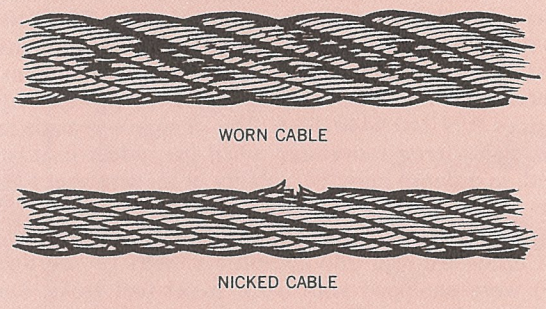
A Convair 990 operator has reported finding frayed wing flap control cables in the area of the flap handle quadrant cutout. This condition is caused by the cable pulling over the edge of the cutout in the quadrant when the handle is in the "Flaps up" position. Fatigue life of these cables can be increased by adding a one-inch radius to the quadrant, as shown in the sketch. Another means of eliminating the sharp bend would be to either relocate the lower pulley, or to splice in a section to replace the cutaway portion of the quadrant.



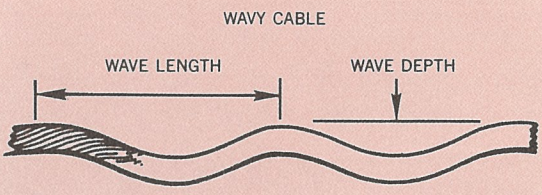
Flap lever quadrant rework



Types of cables



Cable damage requiring replacement.



CABLE DIAMETER	WAVE LENGTH	WAVE DEPTH
3/32	1/2 Min	.010 Max
1/8	1/2 Min	.013 Max

Permissible wave tolerances

MAXIMUM CABIN VENTILATING AIR FLOW
Convair 600

To provide maximum cabin ventilating air flow during alternate air operation (compressor unloaded or disconnected and temperature control on the heating cycle) it is suggested that temperature override switch be held at FULL COLD for two minutes, then turned to OFF. This assures full opening of the back-pressure valve.

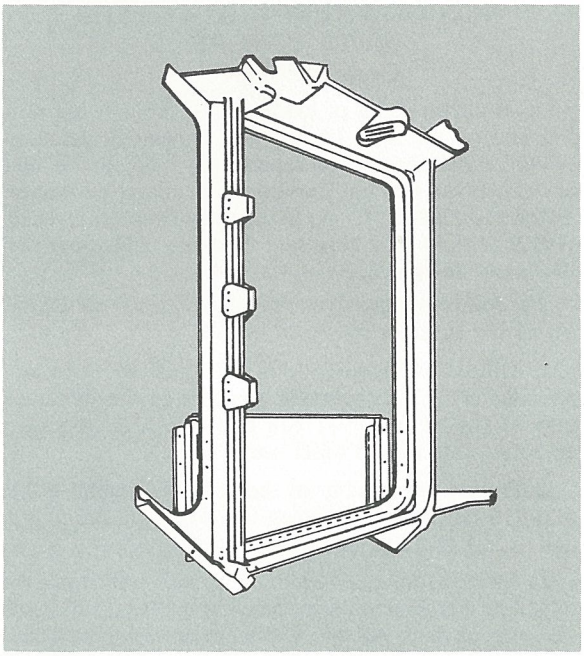
IMPORTANCE OF DV WINDOW DEFLECTORS

Some Convair-Liner operators have requested removal of the direct-vision window deflectors so as to reduce the noise generated by them during flight.

The need for the deflectors was indicated during FAA certification when pilots objected to the strong blast of air that entered the DV window when it was open. In adverse weather, there would be a greater need for opening the DV window. During these periods, the blast of air would be particularly objectionable, since water and ice particles would be blown into the cockpit and into the face of the pilot.

The deflector was installed to divert this air entering the window and thus allow use of the DV window for its intended purpose—to provide forward vision if the main windshields were obscured.

The primary cause of the noise seems to stem from a high-frequency vibration of the deflector in flight. As a means of reducing this vibration, some operators have installed pads between the deflectors and DV windows. These pads, attached to the deflector by a suitable adhesive, have been fabricated from such materials as felt, plastic, and rubber. Additional noise reduction might be realized by installing a heavier material and by potting the edges of the deflector with a silicone material such as Silastic 140.



Convair has no objection to removal of the deflectors; however, operators wishing to remove them would have to demonstrate to their local FAA agency that the DV window can be used as intended without imparing its usefulness.

ELEVATOR HINGE MISALIGNMENT TOLERANCES
Convair 600

Elevators, modified for use on Convair 600 aircraft, have had a doubler, 0.050 inch thick, added to the exterior of the inboard ribs.

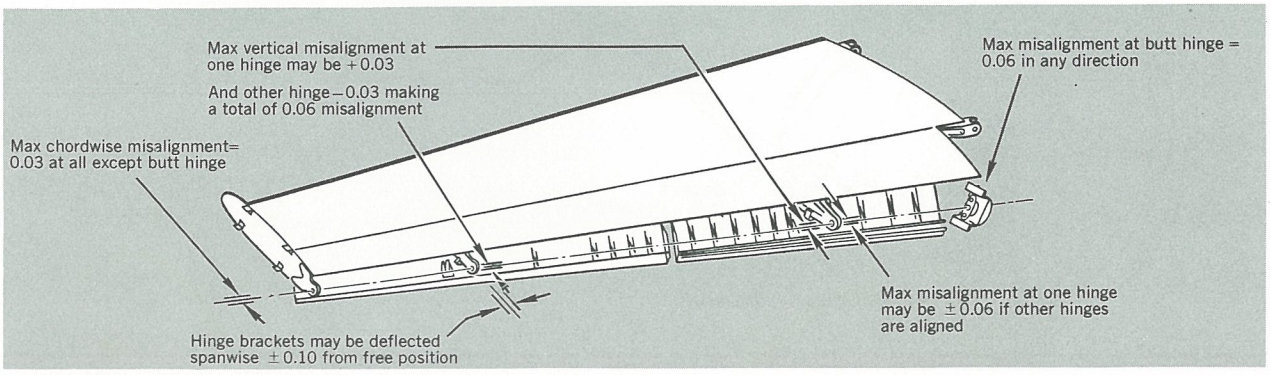
Upon installation, interference is sometimes found between the elevator torque tube flange and these doublers. This results in deflection of the elevator hinge brackets.

When installing a modified elevator, care should be taken to assure that the following limits are not exceeded.

In the event a gap is found between the torque tube flange and the elevator butt rib, shimming is recommended. Misalignment between the elevator torque tube flange and the elevator butt rib can be tolerated up to a maximum of 0.06 inch in any direction.

Interference up to 0.050 inch between the torque tube flange and the butt rib will result in span-wise misalignment within the limits shown. This interference will cause the elevators to move outboard, resulting in span-wise deflection of the hinge brackets. These brackets have a maximum permissible span-wise deflection tolerance of + 0.10 inch from the free position.

These limits, shown in the sketch, will permit use of all modified elevators.



NLG DOWNLOCK ACTUATOR ROD REWORK
Convair 990/990A

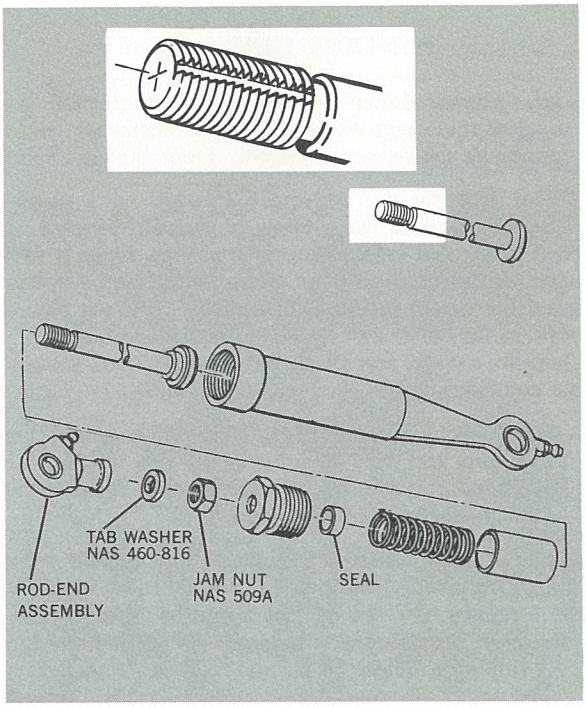
Several occurrences of loosening of the jam nut and rod end on the nose landing gear downlock actuator (9992C-120B) have been reported by Convair 990 operators. If the jam nut loosens, it permits the actuator piston rod (9992C-124A) to unscrew from the rod end (9992C-128A) with resultant incorrect adjustment of the NLG downlock.

The following approved rework will prevent loosening of the actuator rod (see sketch).

1. Mill 0.064 inch depth by 0.12 inch width by approximately 0.7 inch length key slot at the threaded end of the actuator piston rod (-124A), and fair smoothly into thread relief area.

2. During reassembly of the actuator, install NAS 460-816 tab washer between the NAS 509-8 jam nut and -128A rod end assembly.

3. After installing actuator in aircraft and correctly adjusting per Maintenance Manual instructions, bend two tabs of the NAS 460 washer over the wrench flats of the rod end and the remaining tabs over the NAS 509 jam nut flats. See illustration.

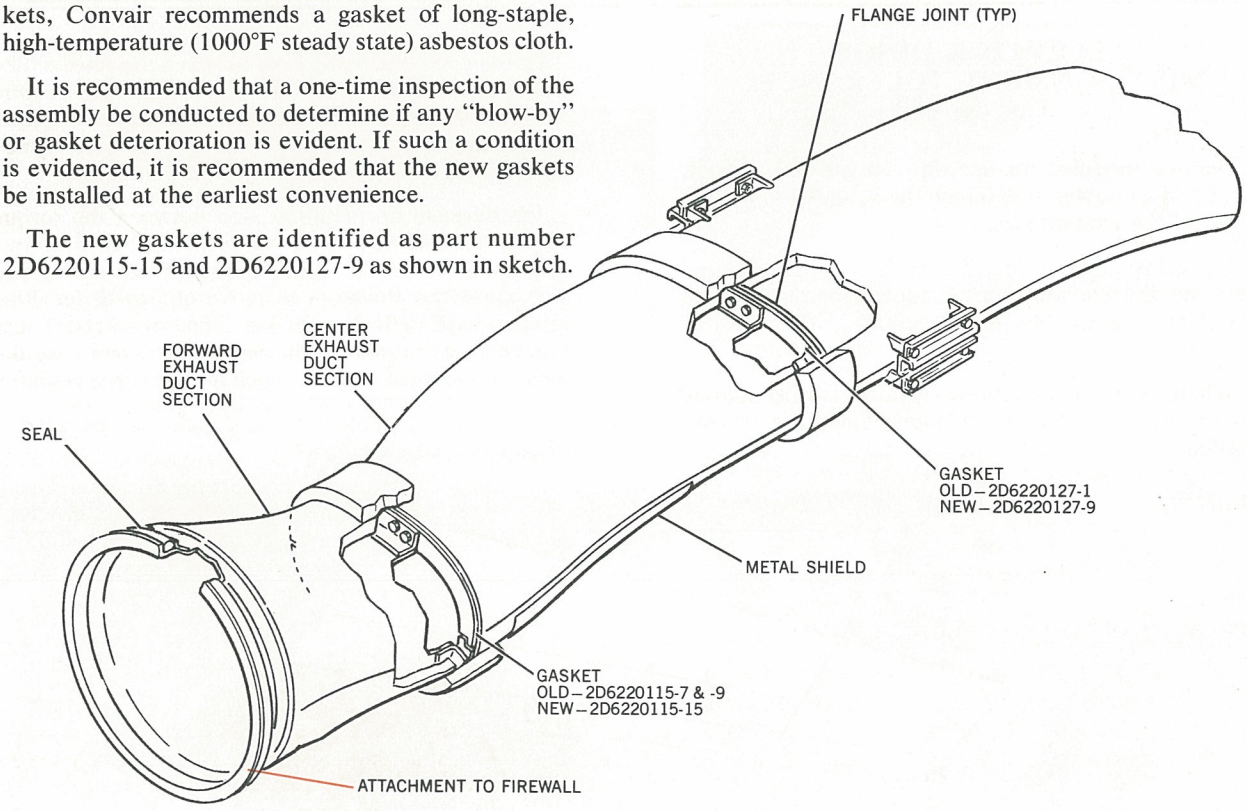


ENGINE EXHAUST DUCT GASKETS
Convair 600/640

To extend service life of the engine exhaust duct gaskets, Convair recommends a gasket of long-staple, high-temperature (1000°F steady state) asbestos cloth.

It is recommended that a one-time inspection of the assembly be conducted to determine if any "blow-by" or gasket deterioration is evident. If such a condition is evidenced, it is recommended that the new gaskets be installed at the earliest convenience.

The new gaskets are identified as part number 2D6220115-15 and 2D6220127-9 as shown in sketch.



CONTROL FORCES
Convair 240/600

One Convair-Liner operator noted heavier than normal forces when the control column was pushed forward. The following values have been established for these forces.

Note

Before making the following checks, it should be determined that the system is properly rigged, that bearings are not worn or binding, and that all components are functioning properly.

ELEVATOR

Using a spring scale, measure the friction of the elevator control column while it passes through neutral. This friction should not exceed 3.00 pounds with the autopilot and counterbalance disconnected.

Measure the friction on the elevator trim tab control system (with autopilot disconnect) for a maximum of 3.5 pounds on the wheel in the cockpit. The allowable play of the elevator trim tab should not exceed the limits contained in the Maintenance Manual for the particular aircraft model.

RUDDER

Rudder pedals should retain alignment when they are manually adjusted from the flight deck. With autopilot disconnected, friction at base of each rudder pedal should not exceed eight pounds when passing through neutral.

AILERON

With autopilot and aileron-rudder interconnecting link disconnected, friction on aileron control wheel should not exceed a torque of 30 inch-pounds when passing through neutral. Friction of trim tab wheel should not exceed 15 inch-pounds when passing through neutral.

PROPELLER OPERATION
MOMENTARY LOSS OF POWER
Convair 600/640

To prevent momentary loss of DC power and a resulting overtemperature condition, Convair will revise the Flight and Maintenance Manuals to include precautions covering "T" handle operation. These precautions are necessitated by incorporation of Alert Service Bulletin A61-5 for the 600, and A61-4 for the 640.

It should be noted that, if a loss of power occurs, the 13,000-rpm holding relays will drop out. It is then necessary to pull the "T" handle again to allow the propellers to fine off to Ground Fine Pitch.

Convair designed and installed an aural warning system that signals the crew whenever ground operations are conducted with the 13,000-rpm holding relays energized. This modification, which was requested by one Convair 600 operator, is available to all Dart operators. Operators may contact Service Parts for additional information and cost quotes.

HYDRAULIC PUMP INTERCHANGEABILITY
Convair 880/880M

Vickers hydraulic pumps on Convair 880 and 880M aircraft are rated at 6 gpm. One Convair 880 operator planned to install a Kellogg pump rated at 10 gpm and wondered if the increased pump capacity would adversely affect operation of the hydraulic system.

The installation of variable-displacement pumps of increased capacity will not compromise hydraulic system operation. In fact, several Convair 880/880M operators are using a Vickers pump rated at 10 gpm.

AIR CONDITIONING SYSTEM PERFORMANCE CHECK
Convair 340/440

On Convair 340/440 aircraft (not on 640), maximum cooling performance can be maintained if the *highest* possible pressure level is maintained at the inlet to the cooling turbine, and the *lowest* pressure to the turbine discharge. Inlet pressure is affected by the following factors:

Engine rpm (1150 rpm minimum),
Duct leakage (from primary compressor to bootstrap unit),
Primary compressor power pressure (2000 psig minimum),
Position of refrigeration bypass valve,
Proper operation of water separator temperature limiter.

Discharge pressure is affected primarily by abnormal obstructions in the turbine discharge ducting.

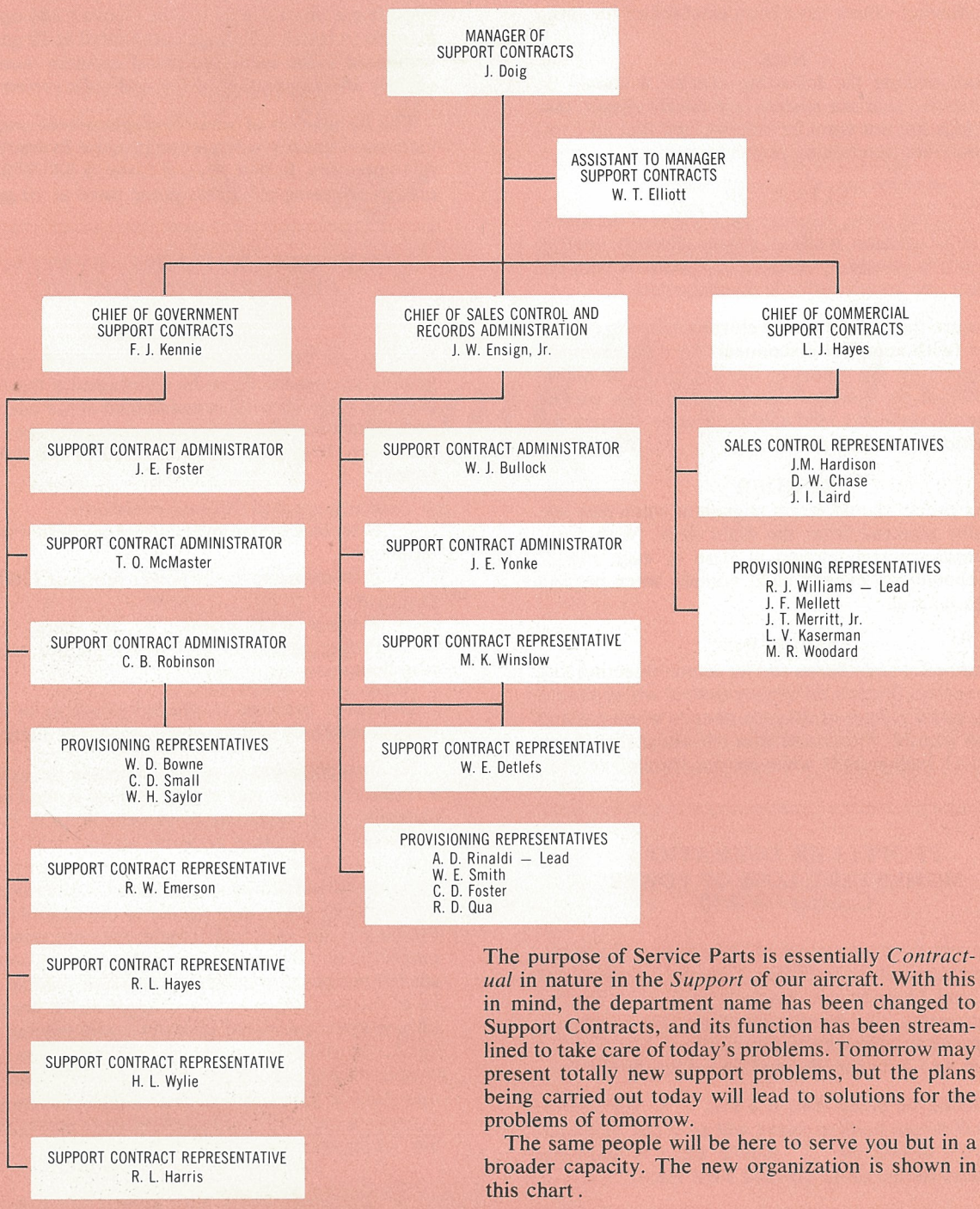
Reading pressures at various points in the system is a relatively simple way of determining ground cooling capability and evaluating component integrity. Primary compressor discharge pressure should read approximately 49″ hg on a standard sea level day with engine up to speed and full cooling selected. A pressure reading of 68″ hg at the inlet header of the secondary heat exchanger can be expected under the same conditions, indicating that ducting is tight and secondary compressor is functioning properly. A pressure reading of 66″ hg at the secondary heat exchanger outlet header (or turbine inlet) compared with a pressure reading of 32″ hg at the turbine discharge will confirm that the turbine is operating at design speed. With the turbine wheel operating at rated rpm and adiabatic efficiency, this expansion ratio will yield a temperature across the turbine of approximately 90°F (dry air rated).

Note

It is important that the ground fan be operating during these checks.

The performance described applies to a system operating at maximum efficiency. Some degradation can be expected with high time equipment; however, this check procedure will expose any gross deficiencies or component malfunctions.

Service Parts Becomes Support Contracts



The purpose of Service Parts is essentially *Contractual* in nature in the *Support* of our aircraft. With this in mind, the department name has been changed to Support Contracts, and its function has been streamlined to take care of today's problems. Tomorrow may present totally new support problems, but the plans being carried out today will lead to solutions for the problems of tomorrow.

The same people will be here to serve you but in a broader capacity. The new organization is shown in this chart.

GENERAL DYNAMICS
Convair Division